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APPENDICES

SCHEDULE 15-2
DESIGN AND CONSTRUCTION – COMMON REQUIREMENTS

PART 4 - STATIONS

ARTICLE 1 INTRODUCTION

1.1 Introduction

(a) The Stations on the Expanded Trillium Line shall be efficient, universally accessible, sustainable facilities that provide Passengers with an enjoyable, comfortable, and safe transit experience.

(b) Stations shall act as a catalyst for TOD and shall enhance connectivity to surrounding neighbourhoods while not precluding integration opportunities with future planned developments.

(c) Project Co shall provide complete Stations and Ancillary Facilities to fully support the operational requirements of the Project while minimizing crowding, travel impedances and physical barriers.

1.2 Overview

(a) The project consists of the design and construction of new Stations and the renovation and alteration of existing Stations for a total of thirteen Stations.

(b) Project Co shall design and construct the Stations and all associated Facilities, and shall obtain necessary Permits, Licences, Approvals and Authorizations in accordance with Schedule 32- City Permits, Licences, Approvals and Authorizations (PLAA) for the same. Station Structures and systems shall be designed and constructed to satisfy the Design Life requirements of Schedule 15-2, Part 1, Article 4 – Design and Construction, Table 1-4.1 and as per CSA S478-95 (R2007) Guidelines on Durability in Buildings. Project Co shall provide the Facilities including but not limited to the following:

(c) Project Co shall provide Stations including:

(i) Line, Terminal, Transfer Stations. Some Stations function as one or more of these types.

A. A Line Station is located within the line and does not intersect with any, Train or Bus Station including the following Stations; Gladstone, Carling, Carleton, Mooney's Bay, Walkley, Bowesville and Uplands;

B. A Terminal Station is located at either end of the Train line including the following Stations; Bayview, Airport, and Limebank; and,

C. A Transfer Station intersects with bus service or Train service integrated with the Station and provides transfer of modes of transportation without requiring revalidation of fare including the following Stations: Bayview, Greenboro, South Keys, Leitrim, and Bowesville.

(ii) Two new Stations shall be constructed on the Existing Trillium Line: Gladstone, and Walkley.

(iii) Four new Stations shall be constructed on the Trillium Line Extension; South Keys, Leitrim, Bowesville and Limebank.

(iv) Two new Stations that accommodate a single Vehicle from the Existing Vehicle Fleet shall be constructed on the Airport Link; Uplands and Airport. These Stations shall be expandable to accommodate future Platform extensions for two coupled Vehicles from the Existing Vehicle Fleet.

(v) The existing five Stations on the Existing Trillium Line shall be expanded to accommodate the Revenue Vehicles and upgraded: Bayview, Carling, Carleton, Mooney's Bay, and Greenboro.

A. Upgrades to the existing Stations shall include but not be limited to:

i. Installation of Project brand signage;

ii. Replacement of the PA system;

iii. Upgrading of PIDS;

iv. Upgrading of communications systems;

v. Upgrading of lighting;

vi. Upgrading of CCTV monitoring systems;

vii. Upgrading of electrical systems;

viii. Upgrading of TSA;

ix. Addition of redundant elevators where required by this Part 4;

x. Upgrading of elevators where required by this Part 4;

xi. Upgrading of landscaping;

xii. Upgrading of Platform furniture; and,

xiii. Accessibility upgrades.

(d) Project Co shall provide Ancillary Facilities including:

(i) Bicycle Facilities;

(ii) Bus Facilities;

(iii) Bus Operator and Maintenance Buildings;

(iv) Station Entry Plaza(s);

(v) PPUDO;

(vi) Off-street Non-Revenue Vehicle parking;

(vii) Pedestrian overpass or underpass structures;

(viii) Passenger shelter structures;

(ix) Structures containing mechanical, electrical, communications or other service equipment;

(x) Signal equipment enclosures;

(xi) Entrances;

(xii) Rail operator crew rooms;

(xiii) Bus lay-by areas; and,

(xiv) Maintenance Facilities: Refer to Schedule 15-2, Part 5 – New Walkley Yard.

(e) Emergency Planning:

(i) Project Co shall be responsible for the preparation, submission and Maintenance (including revisions as necessary) of fire safety plan(s), for approval by the authority having jurisdiction, pursuant to Ontario Fire Code, Section 2.8 Emergency Planning, where applicable, in accordance with Schedule 10 – Review Procedure.

(f) Stations design shall consider pedestrian circulation as a critical element. Station designs shall facilitate the transfer of Passengers from one mode of transportation to another by minimizing transfer effort and to ensure safe exiting under Emergency conditions. Station capacity shall be planned and designed to serve the projected operations for Ridership Demand of the 2048 AM peak contained in this Part 4 and Schedule 15-2, Part 1, Article 3 – Operational Performance Requirements.

(g) All new Stations shall be provided with space and Utility services provisions for installation of a fare control system including but not limited to fare control gates and Ticket Machines to be installed by the City**.**

(h) Airport Station and Uplands Station are located on Airport Lands and are Federally Mandated Stations subject to review by the NCC. Project Co shall be responsible for design and construction of the Stations in accordance with the following:

(i) The National Capital Act makes the NCC responsible for coordinating and approving projects related to Federal Lands and buildings in Canada's National Capital Region. The NCC is a Crown Corporation and therefore functions at a distance from the federal government, reporting to Parliament through the Minister of Canadian Heritage.

(ii) All individuals and federal organizations need NCC approval before undertaking projects on Federal Lands and buildings in Canada's National Capital Region.

(iii) The NCC's mandate to approve federal land uses, transactions and designs is set out in sections 12 and 12.1 of the National Capital Act.

(iv) Project Co's approach to the Federally Mandated Stations shall be subject to review by the NCC and shall be assessed in terms of compliance with the guiding principles contained within this Project Agreement:

A. Project Co shall be responsible to develop designs and design documentation to support the City and the OMCIAA in obtaining NCC approval, including but limited to:

i. Attending meetings with the City, the OMCIAA and NCC;

ii. Providing design documentation, reports, renderings specifications, etc. to be used in the approval process; and,

iii. Project Co shall be responsible for presentations of the Stations/Project to the Advisory Committee on Planning Design and Realty at the NCC.

(v) Project Co Station designs shall reflect a quality of design consistent with the best practice of architecture, landscape architecture, urban design, and universal accessibility. Project Co's designs shall comply with the conditions contained in the NCC's approval letter dated September 14, 2017.

(i) All Stations shall be designed and constructed to permit Emergency Vehicle access. If any new Works are required to ensure Emergency Vehicle access, then these Works shall be the responsibility of Project Co.

(i) At the following Stations, Emergency vehicle access can be via the bus transfer area: Greenboro, South Keys, Leitrim, and Bowesville.

(ii) At the following Stations, Emergency vehicle access can be via the nearest City street: Gladstone, Carling, Mooney's Bay, Carleton, Walkley and Limebank.

(iii) At Uplands Station, Emergency vehicle access can be from Uplands Drive via the EY Centre parking lot to the south of the Station.

(iv) At Airport Station, Emergency vehicle access can be from Airport Parkway Private.

1.3 Design Principles and Guidelines

(a) Accessibility

(i) Project Co shall ensure all Stations and all public spaces excluding Maintenance spaces and services rooms, are designed to optimize accessibility for persons with disabilities in accordance with Universal Design principles. This will include satisfying the requirements of relevant federal, provincial and municipal accessibility legislation, standards, guidelines, practices and criteria, including but not limited to Transport Canada, Canadian Transportation Agency Code of Practice - Terminal Accessibility, AODA, OBC, COADS, as well as CSA Standards (including but not limited to CAN/CSA B651). The application of accessible design legislation, standards, guidelines, practices and criteria shall accommodate the needs of persons with different types of disabilities, including those with auditory, intellectual, physical, developmental, visual, learning, and mental health disabilities.

A. Adequate clearances shall be provided to accommodate Passengers with mobility devices, luggage, strollers, bicycles, service animals, support persons, with access to benches, and equipment at Stations, public facilities, and all TSA's including Platforms at Stations and bus Platforms.

(ii) Project Co shall ensure all accessible public spaces and interior routes are required to be connected to accessible entrances and accessible exterior routes.

(b) Crime Prevention Through Environment Design as follows:

(i) Project Co shall design all Station-related public accessible areas (Platforms, entrances and passageways, sidewalks, landscaping, PPUDO's cycling facilities, MUP's, parking areas, elevators, washroom access, Emergency access, plazas bus Platforms) using CPTED principles. An independently contracted CPTED review and report of the Project design shall be provided to the City by Project Co as part of each design submittal, all of the CPTED report requirements shall be incorporated into the Project by Project Co. The independently contracted CPTED review provided by Project Co shall be performed by a qualified CPTED practitioner or practitioners, in good standing with a recognized CPTED national or international organization and who holds current CPTED certification(s).

(c) Project Co shall implement bird friendly design:

(i) All glazing utilized in the Facilities shall be non-reflective type glazing; and,

(ii) Expanses of glazing system in excess of $2m^2$ shall include pattern to create a visual marker to allow birds to identify the Facilities as solid objects.

(d) Snow Storage:

(i) Project Co shall design and construct all bus Facilities with capacity for snow storage, including bus Platforms, Park & Ride lot, bus loop and bus lay-by areas in accordance with City Standards including OC Transpo Transitway and Station Design Guidelines.

(ii) Where snow storage is planned within landscaped areas, Project Co shall use salt-tolerant landscape materials and vegetation.

(e) Project Co shall design and construct all Stations with provision for Maintenance, including the following:

(i) Access to Station areas without passing through fare gates;

(ii) Access into and through Stations for Maintenance equipment;

(iii) Consideration of roof and ceiling heights above finished floor elevation for Maintenance or replacement of ceiling mounted or supported items;

(iv) Roof access and fall protection for roof mounted equipment; and,

(v) Other requirements listed elsewhere in this Part 4.

(f) Project Co shall develop a single architectural language for the Stations excluding Bayview and Airport Stations, to be implemented during design and construction. The architectural language shall be related to the architecture of the Stations on Confederation Line. The new Stations on the Expanded Trillium Line should provide an upgraded Passenger experience; however the architecture of the Confederation Line Stations is not expected to be carried over to the Expanded Trillium Line. The architectural approach to the Stations shall include the following:

(i) Station entrances shall be prominent and shall have presence from the adjacent public street or Facilities such as Park and Rides. Station indicator signage shall be visible from a distance and be designed in accordance with the Confederation Line signage package as outlined in Article 7.5 (b) of this Part 4;

(ii) Each Station architectural, landscape and urban design shall be integrated with the contextual surrounding enhancing the civic nature of the Project;

(iii) Passenger flow to and through the Station shall be intuitive with the Station and landscape architecture offering visual clues and guidance to the Passenger; and,

(iv) Passenger amenities, fare control equipment, site furniture and wayfinding at Station entrances shall be planned and designed in a consolidated, efficient and coherent manner to avoid a cluttered layout and appearance. Unless site conditions prevent implementation, Station designs shall consider right Passenger flow.

1.4 Key Individuals

(a) Design architect

(i) Project Co shall assign a Design Architect with the qualifications identified in Schedule 9 – Key Individuals, to lead all aspects of the Stations and Ancillary Facilitates design, planning and execution of the same for the Project including the following:

A. Responsible for the creation of and ensuring the execution of the architectural design of all facilities is consistent across the Project.

B. Responsible for coordination and integration of all signage and wayfinding, mechanical, structural, electrical, communications, and Systems, to ensure the integrity of the architectural design.

C. Responsible for Stations and Ancillary Facilities interface and coordination with the City and third parties.

D. Responsible for the interface with all Governmental Authorities.

ARTICLE 2 ARCHITECTURAL DESIGN CRITERIA

2.1 Introduction

(a) This Article presents the specific general criteria that are necessary for Project Co to carry out the design and construction of the components and elements of Stations and other building-type Structures on the System.

(b) Project Co shall design and construct buildings in accordance with all applicable codes and standards.

(c) Where Design Criteria related to Site specific requirements differs from general requirements, Site specific Design Criteria take precedence over general Design Criteria.

(d) Appendices to this article form part of the Project requirements.

(e) Code Analysis

(i) Project Co shall perform a code analysis with respect to the OBC, NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems. For Federally Mandated Stations, a code analysis for the NBCC shall also be performed. The code analysis for each Station shall address the following minimum requirements:

A. Building Size, Use and Occupancy;

i. Building area and number of storeys;

ii. Mezzanines; and

iii. Description of Stations as either open or enclosed;

B. Structural design:

i. Including where the existing Transitway and Existing Trillium Line retaining walls form part of a Station;

C. Occupant load;

D. Construction requirements;

E. Interconnected floor spaces;

F. Spatial separation;

G. Fire department access;

H. Fire separations and compartmentalization;

I. Egress and exiting;

J. Fire protection systems, Emergency power and communication systems;

K. Washrooms;

L. Barrier Free Design; and,

M. Alternative Solutions:

i. Description of performance; and

ii. Proposed method of compliance.

2.2 Codes and Standards

(a) Project Co shall design and construct all Facilities in accordance with applicable laws, codes, standards, regulations, guidelines and Governmental Authority.

(b) Where the requirements stipulated in this document or any referenced sources are in conflict, refer to Schedule 15-2, Part 1, Article 1 – Reference Documents and Submittals for order of precedence.

(c) The following codes, standards and regulations shall apply to the Works:

(i) OBC;

(ii) AODA;

(iii) COADS;

(iv) OFC;

(v) OC Transpo Transitway and Station Design Guidelines;

(vi) The Ontario Heritage Act;

(vii) CSA including:

A. CAN/CSA B44 Safety Code for Elevators and escalators (latest edition including Appendix E);

B. CAN/CSA-B651 Accessible Design for the Built Environment;

(viii) MNECB;

(ix) CPTED as defined on the CPTED website: cptedontario.ca;

(x) OHSA;

(xi) MTO;

(xii) NBCC Applicable to Stations located on Federal Lands; and,

(xiii) NFPA.

(d) Application of OBC related to Stations:

(i) Project Co shall determine the appropriate Group and Division applicable to the Station Facilities based on the Project Co's design;

(ii) Notwithstanding the above, Project Co shall comply with the following:

A. Bayview Station Trillium Line Platform area is considered part of the Existing Bayview Station Building classified as a Rapid Transit Station and thus is required to comply with OBC 3.13;

i. Existing washrooms are not required to be upgraded to meet OBC 3.13 requirements;

B. Stations shall comply with the following clauses of OBC 3.13 Rapid Transit Stations:

i. 3.13.1.2. Definitions;

1 Though the Existing Trillium Line does not meet the definition of rapid transit system, this does not relive Project Co from compliance with OBC 3.13 as identified in this Article;

ii. 3.13.2. Construction Requirements – Applicable to all portions of Stations constructed over the Guideway, including existing fare control buildings;

iii. 3.13.3. Safety Requirements Within Stations;

iv. 3.13.4. Means of Egress;

v. 3.13.5. Fire Safety Provisions;

vi. 3.13.6. Required Sanitary Facilities, applicable at Limebank Station only; and,

vii. 3.13.8.4. Emergency Operation of Elevators.

2.3 Elements of Continuity and Variability at Stations

(a) The design of each Station shall utilize a common vocabulary of elements and features that unify and identify the System as a whole and convey a sense of its public purpose.

(b) The Station designs shall have continuity of overall functional layout and placement of operational devices and amenities.

(c) Station design elements are divided into two classifications: Elements of Continuity and Elements of Variability as defined below.

(i) Elements of Continuity provide consistent Station designs for the purpose of system-wide identity, functional consistency, and efficiency in capital, operations, and Maintenance costs.

(ii) Elements of Variability are not required to be consistent between Stations.

(d) Project Co shall provide Station elements which are continuous or variable in accordance with Table 4-2.1:

Table 4-2.1 – Station Elements of Continuity (C) or Variability (V)

DESIGN ELEMENT	C or V
Wayfinding, Signage and Visual Displays	
Signage	C
Advertising	C
Vertical circulation	
Stair details (typical dimensions, details and finishes)	C
New elevator details	C
Existing elevator details	V
Sloped walking surfaces and ramp details	C
Communications	
Public address system and speakers	C
ETEL	C
Assistance for hearing impaired	C
Telephones	C
Transit information panels(TIP)	C
Closed-Circuit Television (CCTV) equipment	C
PIDS	C
Station control and security	
Transecure Area and equipment	C
Fare equipment **	C
Emergency exit and security gates	C
Site development – Outdoor Areas	
Road, sidewalk and pathway hardscape surface treatment*	V

DESIGN ELEMENT	C or V
Landscaping*	V
Street Furniture*	C
Retaining walls*	V
Bollards, bumpers*	V
Fences	V
Lighting	C
Bus Platform shelters	C
Trash and recycling receptacles	C
Bicycle rings/racks	C
Bicycle shelters	C
TWSI	C
PPUDO	C
Station – Interior Areas	
Doors, gates, and hardware	C
Floor finishes *	C
Wall and ceiling finishes public areas *	C
Light fixtures*	C
Canopies	C
Vents and ventilations Shafts	V
Handrails—public areas	C
Guardrails—public areas	C
Railings/handrails—emergency exits	C
Drinking fountains/bottle filling stations	C
Platform edge tile	C
Public stairway details and materials	C
Bus and Train Station Platform Shelters	C
Emergency stairway details and materials	V
Platform service gates	C
Fire hose cabinets	C

DESIGN ELEMENT	C or V
Washroom fixtures, accessories & finishes	C
Tactile Wayfinding system	C
Platform Furniture and fixtures	C
* Consistent within a range ** Provided and installed by others	

(i) Where elements of existing Stations are to remain, such as recently installed fare equipment, these elements shall be excluded from the requirements of Table 4-2.1.

(ii) All elements of Bayview Station shall be consistent with the existing Station elements constructed under the Confederation Line.

2.4 Station Sizing and Capacity

(a) General:

(i) Project Co shall provide Station designs sized to accommodate the anticipated Operational Performance Requirements outlined in Schedule 15-2, Part 1, Article 3 – Operational Performance Requirements utilizing the 2048 AM peak hour Passenger demand.

A. The design shall reflect Passenger volumes accommodating peak loads from arriving / departing Trains, entraining occupant load awaiting Trains, buses and standing Passengers.

B. Project Co shall design Uplands Station and site to accommodate events at the EY Centre.

i. Project Co shall design all Station components, including the exiting requirements for vertical circulation utilizing the crush load of a two Train consist, operating on a 12 minute headway.

ii. Project Co shall be required to construct the Station per item i above, with the exception of the Platform length which shall be constructed to accommodate only a one car Train.

iii. The required Platform width shall be constructed to satisfy the greater of the following:

1 A minimum width of 5.0m;

2 The width required for a one car Train Platform length; or,

3 The width required when the Platform is lengthened to accommodate a two car Train.

(ii) Project Co shall provide bus transfer Stations and Platforms to accommodate the peak hour bus transfer operations including Passenger flows and bus volumes

(iii) Project Co shall design and construct Stations, Platforms and circulation elements both horizontal and vertical to meet the following minimum requirements:

A. Minimum emergency egress requirements shall satisfy the requirements of the OBC.

B. A Platform clearance time of no more than 0.8 times the shortest Headway anticipated under normal operations for the ultimate design capacity.

i. For centre Platform Stations, two Trains arriving at the same time shall be considered as the base case for modeling purposes.

ii. For side Platform Stations with a shared Concourse Level, two Trains arriving at the same time shall be considered as the base case for modeling purposes.

(b) Level of Sservice:

(i) The following levels of service indicated below shall be provided in the design of public spaces as referenced in other parts of this article:

Location	**Level of Service (LOS)**	**Measure**
Platforms (Normal)*	C	0.8m^2 per person
Platforms (Emergency)*	D	0.4m^2 per person
Waiting Areas	C	0.8m^2 per person
Passageways/bridges – 1 way	D	50 ppm per metre
Passageways/bridges– 2 way	C	40 ppm per metre
Stairways – 1 way	E	55 ppm per metre
Stairways – 2 way	D	35 ppm per metre

**Note: Normal Platform refers to the LOS during the daily peak 15 minutes. Emergency Platform refers to the LOS provided during an Emergency in which an incoming fully loaded Train shall evacuate onto a Platform with waiting Passengers at the daily peak 15 minutes.*

(c) Project Co shall provide calculations and Passenger modeling simulations to demonstrate that generous public spaces have been achieved in Station design and that a high LOS has been provided for Passenger circulation including calculations for all aspects of the Station circulation including but not limited to the interior circulation, vertical circulation, Platforms, Site circulation, bus Platforms, and at entries and exits. Stations design shall consider intuitive Passenger flow, minimizing obstacles and pinch-points. Calculations and Passenger modeling shall be submitted according to Schedule 10 – Review Procedure.

(i) Calculations and modeling shall be based on the operation parameters in this Part 4 and Schedule 15-2 Part 1, Article 3 – Operational Performance Requirements for 2048 AM peak ridership demand.

(ii) The software utilized by Project Co shall be a proven and widely used product in the design and analysis of rapid transit and intermodal transit facilities.

A. Assumptions used in calculations and modelling simulations shall be confirmed and agreed upon between Project Co and the City, prior to completing any calculations or modeling.

(iii) The design of the Station Facilities shall be adjusted based upon the results of the simulation.

(iv) The Passenger simulation analysis shall be submitted in accordance with Schedule 10 – Review Procedure.

(v) Passenger modelling shall include all physical barriers, such as columns and Station furniture, and include surge spaces around station equipment such as fare equipment and elevators.

(d) Surge spaces, queuing and runoff

(i) Project Co shall be responsible for determining the amount of queuing space required at each element within the design to meet the LOS required in each area. The calculated requirements shall be equal to or greater than the requirements below for the following items;

A. Surge space provided at the top and bottom of public stairs shall be a minimum of 5000mm

B. Runoff provided space in front of an elevator shall be a minimum of 3000mm

C. Queuing distance provided at fare gates, entry and exit sides shall be a minimum of 5000mm measured from the leading and trailing limits of the gate pedestal.

i. Where rolling grilles or other similar devices are provided at a Station entrance, the coiling door shall not be located as such to reduce the required 5.0 metre surge space from the fare gate.

D. Queuing space provided at a Ticket Machines shall be:

i. A minimum of 3000mm when facing a wall or obstruction.

ii. A minimum of 2000mm when adjoining another queue space.

E. Queuing space provided at all doors for use by the public at the Station within the flow path of Passengers to and from entries, Platforms and vertical circulation, exclusive of coiling doors and grilles, shall be a minimum of 3000mm.

F. Where two or more elements listed above converge, the surge or runoff spaces shall be cumulative.

(ii) Queuing and runoff spaces listed in item (i) above are applicable to new Stations.

A. Non-conformant queuing and runoff spaces including stairs elevators and fare equipment as currently constructed at existing Stations are not required to be modified, provided existing elements remain unmodified in Project Co's design solution.

(e) Platforms

(i) All Platforms on the Expanded Trillium Line shall comply with the following:

A. The width of the Platform shall be the greater of the following: the minimum required in this article; the minimum required by OBC; the minimum required by NFPA 130; or the minimum width to satisfy the LOS and ridership requirements, and Schedule 15-2, Part 1, Article 3 – Operational Performance Requirements.

B. Refer to Schedule 15-2, Part 3, Article 9 – Intrusion Access Control System for monitoring and detection requirements to detect unauthorized intrusions from Station Platforms to Track-level at Platform end gates.

(ii) Station Platforms:

A. All Stations shall have a minimum 77m long Platform to accommodate the Train consist.

i. Airport and Uplands Stations shall be constructed with an initial minimum Platform length of 40m with design allowances and provisions to allow extension of the Platform to a minimum of 77m.

B. The scale and number of Platform elements within public spaces shall be organized to avoid clutter and maximize the proportions of open space.

C. Non-public service areas or rooms may be located under vertical circulation elements.

D. Station Platform width

i. Side Platforms shall be a minimum of 5000mm wide.

ii. Centre Platforms shall be a minimum of 10500mm wide, except for South Keys Station.

iii. South Keys Platform shall be a minimum of 8290mm wide.

iv. A clear circulation width from the Platform edge shall be maintained in accordance with OBC.

E. In accordance with Schedule 15-2, Part 2, clauses 1.1(c) and (d), Station Platforms, with the exception of Limebank, Bowesville, Uplands and Airport, shall be equipped with slip-resistant retractable Platform edge extenders along the entire length of the Platform, and providing the required clearance for the passage of freight Trains through the Station Platform area in the retracted position.

(f) Ridership Forecast Data

(i) Project Co shall be responsible for ensuring that the SI supports the Passenger demand in Table 4-2.2 and Table 4-2.3 below, and in accordance with this Part 4 and Schedule 15-2, Part 1, clause 3.4 – Operational Design and Construction Requirements.

(ii) Project Co shall utilize a ratio of 90.0% to convert the AM peak hour ridership forecast to a PM peak hour ridership forecast.

Table 4-2.2: 2031 AM Peak Hour Ridership Forecast

Stations	2031 AM Peak Hour Ridership Forecast					
	NB Boardings	NB Alightings	NB Load	SB Boardings	SB Alightings	SB Load
Airport	80	0	-	0	130	-
EY Centre /Uplands	0	0	-	0	10	-
Limebank	410	0	410	0	80	0
Bowesville	870	0	1,280	0	130	80
Leitrim	280	0	1,560	10	10	210
South Keys	150	80	1,630	140	60	210
Greenboro	360	60	1,930	30	20	130
Walkley	40	20	1,950	0	20	120
Mooney's Bay	50	70	1,930	0	90	140
Carleton	60	1,390	600	30	1,020	230
Carling	0	240	360	190	0	1,220
Gladstone	0	90	270	130	0	1,030
Bayview	0	270	0	900	0	900

Table 4-2.3: 2048 AM Peak Hour Ridership Forecast

Stations	2048 AM Peak Hour Ridership Forecast					
	NB Boardings	NB Alightings	NB Load	SB Boardings	SB Alightings	SB Load
Airport	90	0	-	0	146	-
EY Centre /Uplands	0	0	-	0	11	-
Limebank	800	0	800	0	80	0
Bowesville	1,120	0	1,920	0	150	80
Leitrim	400	0	2,320	10	20	230

South Keys	160	220	2,260	140	70	240
Greenboro	350	160	2,450	30	20	170
Walkley	40	50	2,440	0	20	160
Mooney's Bay	50	140	2,350	10	100	180
Carleton	60	1,440	970	30	1,010	270
Carling	0	310	660	190	07	1,250
Gladstone	0	110	550	180	0	1,060
Bayview	0	550	0	880	0	880

2.5 Circulation and Egress

(a) Vertical Circulation

(i) Project Co shall design and construct elevators in accordance with the following:

A. Where Station design requires elevators, except where noted in this section, each Station Platform, concourse, and entrance shall be serviced by redundant elevators or other alternative route as described in this Part 4.

i. The crossing of City or private streets to satisfy the redundancy requirements is prohibited.

ii. An alternative accessible means of vertical transportation such as a ramp shall be permitted, provided the alternative means is within 50m, when measured on the path of travel.

iii. Project Co shall ensure the alternative means, such as a ramp, is winter maintained and lit to minimum requirements of this Part 4.

B. Where Station design requires elevators, a minimum of one elevator serving each Platform, and all levels of the Station, shall be provided and sized to allow for an ambulance stretcher in the prone position and customers with bicycles. The other elevator shall provide redundancy for accessibility purposes.

C. All elevators shall meet the following general requirements:

i. Conform to all applicable Acts and codes, including the CAN/CSA B44 Safety Code for Elevators and Escalators (latest edition including Appendix E), OBC, NFPA, NBCC, AODA, CSA Accessible Design for the Built Environment CAN/CSA B651, and COADS;

ii. Be of components and construction designed to conform with Project Co's Maintenance responsibilities as defined in Schedule 15-3 – Maintenance and Rehabilitation Requirements;

iii. Traction elevators shall be provided where they serve more than 14m of travel; and,

iv. No running time, cycle counters or trip counters that would cause the elevators to shut down or alter its operation in any way shall be provided.

D. In addition all new elevators shall have the following:

i. The elevator car walls and hoistway walls shall be constructed utilizing glass. Both elevator cab and hoist way enclosure shall be constructed of glass to the maximum extent possible in all Stations.

ii. At a minimum, 50% of the total elevator cab and hoist way's vertical enclosure surface area shall be constructed of glass;

1 Glass surfaces of the elevator and elevator hoistway shall be aligned.

iii. CCTV camera coverage shall be provided within the cab and at each landing;

iv. Access locations to elevators shall be weather protected so as to minimize the infiltration of precipitation into the elevator shafts and or cabs;

v. Elevator cab flooring shall be aluminum, rubber, or other durable, non-absorbent material with a non-slip surface with coefficient of friction of not less than 0.60;

vi. Elevators shall accommodate a minimum capacity of 1180kg, or the heaviest piece of equipment to be transported between levels for Maintenance, whichever is greater;

vii. The minimum inside cab dimensions shall be 1370mm wide x 2032mm deep with 915mm wide x 2135mm high doors for any door location other than centred which shall be a minimum of 915mmx2153mm or to accommodate the largest unit of Maintenance equipment that must be transported between the levels served, whichever is greater;

viii. Minimum car operating speeds shall be 0.5m per second for elevators with a travel distance of less than 20m and 1.0m per second for elevators with a travel distance of more than 20m;

ix. Elevator machine rooms shall be located as near as possible to hoist ways with a maximum distance of 20m, clear of public walking and landing areas;

x. Oil heaters shall be installed in the hydraulic elevator storage tank if the elevator is not in a heated area;

xi. Elevators shall be equipped with a self-recharging battery pack which shall maintain lighting, return the elevator to level of fire department access, open the doors, and render the elevator inoperative in the event of a power failure;

xii. All elevator keying shall match the keying of the existing elevators within the Existing Trillium Line;

xiii. Elevators shall be equipped with a help hands-free intercom/telephone connected with TOCC;

xiv. Graffiti-resistant finish material in the cab interior shall be provided;

xv. Elevators shall be equipped with a urine detection system;

xvi. Lighting in elevator cabs shall be LED fixtures. Lighting shall be covered with a protective transparent shield to prevent vandalism;

xvii. The operating status of the elevator shall be monitored by the BMS system and the TOCC;

xviii. Elevators shall be controlled at the Station only;

xix. Elevators intended for use in moving equipment to and from locations within the facility shall be sized to accommodate the intended equipment;

xx. Elevator pit walls shall be lined with a non-porous material and shall be drained waterproofed; and,

xxi. Existing elevators within Station Facilities that are used in Project Co design shall be replaced or refurbished to meet at a minimum the following:

1 Existing cab and shaft doors shall be replaced with full glass doors;

2 Existing control equipment and mechanical components shall be upgraded to be compatible with the BMS and TOCC monitoring requirements, including addition of CCTV; and,

3 Project Co shall be responsible to make all upgrades to existing elevators in order to obtain certification of the equipment, including meeting updated accessibility standards.

(b) Project Co shall design and construct stairs and ramps in accordance with the following:

(i) Stairs

A. New stairs shall be constructed of precast or cast in place concrete with precast concrete treads with cast in nosing. Tactile warning strips shall be provided as required by OBC, AODA and COADS.

B. Exterior stairwells shall be fully weather protected or heat-traced to ensure safe usage during the winter;

C. Sizing shall be per code minimum requirements and per LOS requirements as required elsewhere in this Part.

D. Project Co shall design and construct all stairways in compliance with the following criteria:

i. Open risers shall not be permitted;

ii. Continuous railings shall be provided on both sides of the stairs;

iii. Stairs rise and run shall be 30 degrees;

iv. Exterior stairway landing levels shall include a grated drainable catchment basin to trap grit, water and snow; and,

v. All public stairs, interior and exterior, shall include a bicycle wheel trough on one side of each flight of stairs.

1 For new construction, the bicycle trough shall be integral with the stair construction.

2 For existing stairs, the trough is permitted to be surface applied, provided the trough, fasteners and accessories to do not reduce the required egress width.

3 All bicycle wheel troughs shall include textured, non-slip surfaces to provide traction for bicycle wheels.

B. Existing stairs shall be refurbished or replaced to satisfy the Design Life requirements outlined in Schedule 15-2, Part 1, Article 4 – Design and Construction.

(ii) Railings

A. Guardrails and handrails where required by code shall meet all relevant accessible design standards and be provided as follows:

i. The design and construction of guardrails for all Stations shall be consistent in all aspect of design, materials, and dimensions. Guardrails for public areas, stairs, ramps and landings required by code shall be designed and constructed utilizing glazing, with point supported or framed glazing systems.

ii. Guardrail systems for locations other than, public areas, stairs, ramps and landing, are permitted to be of any material meeting or exceeding the guardrail requirements as per OBC.

iii. All handrails associated with public stairs shall be stainless steel pipe sections Type 304 alloy conforming to ASTM A167, with smooth brushed finish, supported by cast aluminum or stainless steel bracket supported from wall or guardrail system.

iv. Railings and Platform gates shall be provided at the Platform ends, if otherwise unprotected, and shall be set back a minimum of 300mm from the edge of the Platform or minimum distance of the freight Train envelope clearance requirement where applicable.

v. Vertical railing supports shall be welded flush to preinstalled embedded anchor plates.

(iii) Ramps

A. All interior and exterior ramps shall be designed and constructed to be universally accessible, including satisfying the requirements of OBC, AODA COADS and applicable CSA Standards, including but not limited to CAN/CSA B651; and,

B. Exterior ramps shall be fully weather protected or heat-traced to ensure safe usage during the winter.

(c) Project Co shall design and construct doors in accordance with the following:

(i) Where doors are provided in public spaces, power door operators shall be provided for at least one public door into each publicly accessible room and entrances or as required by COADS and the Building Code.

(ii) All doors shall have a 980mm minimum clear width.

(iii) Exposed edges of frameless transparent glass public doors and panels shall be framed with a 70% colour contrast material compared to surrounding wall surfaces.

(iv) Framed glass public doors shall be finished with a 70% colour contrast material compared to surrounding wall surfaces.

(v) Where door and frame assemblies are opaque, they shall be finished with a 70% colour contrast compared to surrounding wall surfaces.

(vi) All doors and gates securing the perimeter of the Station, inclusive of service doors, shall be provided with electronic key card access and shall be monitored at the TOCC through the IAC system.

(vii) All Emergency egress doors and gates shall be provided with an exterior light that remains on during all hours of darkness and shall be signed for restricted access.

(d) Project Co shall design and construct circulation in accordance with the following:

(i) Public Passageways

A. The design and construction of public spaces for all Stations shall be consistent;

B. Where a public passageway is in an open area, the main accessible path of travel shall be identified by tactile floor wayfinding indicators from entrances to the Platform level and all Passenger amenities;

C. Floor drains and grilles shall be compatible with the use of mobility devices such as but not limited to canes and crutches, as per AODA 191 / 11 Regulation 413/12 Design of Public Spaces; and,

D. All public areas shall have full CCTV coverage.

(ii) Non Public

A. The minimal acceptable width of passageways for non-public use shall be the greater of the following: code calculated minimum, 1200mm, or sized as required to move equipment for Maintenance.

(iii) Public-Use Pedestrian ways within Fare Paid Zone

A. The absolute minimum clear width shall be 4000mm, unless existing to remain, or sized to satisfy the LOS indicated in other parts of this Article and meet or exceed the greater of the exiting requirements as set forth in the OBC.

B. The minimum clear height shall not be less than 3500mm, unless existing to remain.

(iv) Public Use Pedestrian ways outside of the Fare Paid Zone (Underpasses, and Tunnels)

A. Unless indicated otherwise, the minimum width shall be 6000mm, unless existing to remain or otherwise specified in the Project Agreement. Refer to Schedule 15-2, Part 6, Article 4 - Site Specific Desired Outcomes for Site specific requirements;

B. The minimum clear height of the structure shall not be less than 3000mm;

C. The minimum clear height to any signage, light fixtures, etc., shall be 2700mm; and,

D. Lighting shall conform to the requirements in Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(e) Project Co shall design and construct Emergency Egress in accordance with the following:

(i) Egress to Track level from the Platform along the length of the Platform for purposes of satisfying code exiting requirements is prohibited except as per clause (ii) below.

(ii) Where required, exit off the Platform in accordance with the following:

A. Doors/gates protecting the Platform shall be sized appropriately to satisfy code requirements.

B. Doors/ gates at Platform shall be equipped with panic device hardware.

C. The position of doors/ gates shall be monitored at the TOCC. Unauthorized opening of the gate shall sound an audible signal in the Station and notify the TOCC.

D. At Track level a fence to prevent public access to the Tracks and or crossing the Tracks.

i. Guardrail system shall be designed and constructed to meet the OBC requirements for a guardrail including but not limited to structural capacity and balustrade spacing.

E. The path of travel shall lead to a public way, be lit, and winter maintained.

F. Crossing of the Tracks to access the public way is strictly prohibited.

(iii) At Stations, exits forming part of the emergency egress route shall direct Passengers onto City property only, unless otherwise indicated elsewhere in the Project Agreement.

(iv) Where pathways connecting a Station Platform to a MUP or roadway, or roadway sidewalk are provided to satisfy Emergency egress from the Stations the walkways shall be designed and constructed follows:

A. Provided with lighting.

i. The lighting level shall at a minimum meet the requirements of OBC for emergency egress lighting; and,

ii. Lighting shall be interconnected with the fire alarm system and be activated only in the event of an Emergency situation.

B. Project Co shall winter maintain the pathway to ensure pathway is kept clear of snow and ice during all hours of operations.

(f) Project Co shall design and construct Station entrances in accordance with the following:

(i) Project Co shall provide doors, rolling grilles or ornamental gates or other means to secure the Station building public entrances during hours of non-operation for all Stations with elevators, inclusive of Bayview Station.

(ii) At Leitrim, Bowesville, and South Keys Stations, each mode of transportation shall be capable of being secured separately when hours of operation differ.

A. At Transfer Stations public access to/from the bus Platform shall be maintained 24 hours per day.

B. Ticket Machines shall be accessible to Bus customers outside of the Fare Paid Zone.

(iii) All doors, rolling grilles, etc. used to secure the Stations shall be equipped with electrically operators, and controlled both locally and remotely from the TOCC.

(iv) For Stations other than those with elevators, securing the Station will be achieved by the City through deactivation of the fare gates during non-operational hours.

(v) Project Co shall provide recessed floor grilles at all new Station entrances located directly adjacent to the fare gates:

A. The floor grill shall extend the full width of the fare gate array and a minimum distance of 2.5m from the leading and trailing face of the fare gate pedestal;

B. Each floor grille shall be equipped with a floor drain; and,

C. Each floor grill drain and drainage pan shall be heat traced.

(g) Project Co shall design and construct tactile floor wayfinding in accordance with the following:

(i) Provide tactile floor wayfinding throughout all Stations inclusive of bus Facilities and bus boarding locations within the Fare Paid Zone, in compliance with to OBC, COADS and CAN/CSA B651: Accessible Design for the Built Environment.

2.6 Functional Requirements

(a) Project Co shall design and construct Stations to meet the functional requirements as indicated in Appendix A of this Part 4:

(i) Where bus services are provided, the design and construction of the Stations shall provide all surface facilities including bus Platforms, drives, slips, etc. to accommodate all buses including articulated and double decker buses.

(ii) All OC Transpo facilities, (bus operator rooms, rail Operator rooms, washrooms, lunchrooms, etc.), shall be Universal Design.

(iii) In addition to meeting OBC, all washrooms shall be designed and constructed to meet the requirements of COADS.

(iv) Where required in Appendix A of this Part 4, bus operator Facilities shall be provided as follows:

A. All bus operator Facilities at all Stations shall be standalone Facilities.

B. All bus operator Facilities shall be located as to separate OC Transpo bus operators from Passenger areas and bus Platforms.

C. New Facilities shall be constructed to meet the requirements of the City's standard bus operator building, and non-specified standard drawings and specifications needs to be reviewed and confirmed by OC Transpo for elements that are not detailed in the Transitway Manual.

D. All bus Stations shall be provided with a designated walking area for bus operators to safely walk between the bus lay-up and bus operator facility.

E. Program elements within the facility shall include the following:

i. Multiple occupancy male washroom with ceiling mounted embossed stainless steel partitions with the following plumbing fixture count;

1 Two lavatories;

2 Two water closets; and,

3 One urinal.

ii. Multiple occupancy female washroom with ceiling mounted embossed stainless steel partitions with the following plumbing fixture count;

1 Two lavatories; and,

2 Two water closets.

iii. Universal washroom satisfying the requirements of COADS and CAN-CSA B-651;

iv. Janitor closet with mop sink, accessible from within the Facility;

v. Breakroom with kitchenette with sink, and casework for concurrent use by four people;

1 Space and services for a microwave oven, refrigerator vending machine and toaster oven; and,

2 Water drinking fountain with bottle filler.

vi. All accessories in staff areas, such as toilet seat covers toilet tissue, soap, paper towel dispensers, and disposal units shall meet OC Transpo specifications;

vii. General power requirements, including dedicated power circuits for each of the following: microwave oven, refrigerator and toaster oven; and vending machines;

viii. Staff work areas;

ix. Maintenance room with slop sink, accessed from the exterior and from the staff area:

1 Room shall be a minimum of $60m^2$, with no side less than 6m;

2 Shall be equipped with a personnel door and a 4m wide overhead door to the staff area; and,

3 Shall have at a minimum of one floor drain.

x. Building entry and Maintenance room shall have electronic access control;

xi. Mechanical and electrical support rooms;

1 Project Co shall provide a building automation system per Article 5 - Mechanical Design Criteria of this Part 4 that is compatible with existing OC Transpo building management system.

xii. Conditioned communication room to support of City equipment; and,

xiii. New buildings shall be designed and constructed with materials compatible with the adjacent Station and be consistent with the Confederation Line bus operators buildings;

F. Buildings shall provide illumination level of 25fc to be achieved via natural daylighting over 75% of all floor spaces and windows conforming to City's standard bus operator building requirements;

G. Building shall be equipped with telephone and data services.

i. All staff spaces shall be equipped with data and communications outlets.

H. The flooring in all spaces excluding building service support spaces and the Maintenance space shall be finished with Stonehard flooring system or other similar resinous flooring system as approved by the City.

(v) Project Co shall provide Operator rooms at Limebank and South Keys Stations, the design and construction of the Operator rooms shall at a minimum include the following:

A. Breakroom with kitchenette with sink, and casework designed for concurrent use by six people;

B. In addition to general power requirements, Project Co shall provide dedicated power circuits for each of the following: microwave oven, refrigerator, vending machine, and toaster oven;

C. Data/communication Outlets to support a minimum of two computer workstations;

D. Phone line;

E. Space for a refrigerator, microwave oven, vending machine, and toaster oven;

F. Water drinking fountain with bottle filler;

G. Double tier lockers

i. 16 unit, 300mm w x 300mm d x 900mm h each;

H. Universal single occupancy male washroom;

I. Universal single occupancy female washroom;

J. Located directly adjacent to Platform;

K. The flooring in all spaces shall be finished with Stonehard flooring system or other similar resinous flooring system as approved by the City;

L. In addition to general requirements, Project Co shall provide a dedicated space for Operator sign-in including redundant workstations, electronic crew time clock system, radio charging station for up to 12 radios, and a small lockable filing space for keys, forms, and other paraphernalia; and,

M. Project Co shall provide space for and provide one 32" wall mounted electronic display with power and data connection for the HASTUS system.

(vi) Project Co shall provide one 32" wall mounted electronic display with power and data connection for the HASTUS system within the existing Operator room at Bayview Station.

(b) Rail Superintendent office

(i) A Rail Superintendent's office shall be provided at Limebank Station:

A. Shall be located adjacent to the rail Platform within the Station;

B. Shall be have a minimum area of $12m^2$ with no side less than 3m;

C. Shall be conditioned; and,

D. Shall be equipped with a minimum of two data and two telephone connections.

(c) Bus supervisor's office

(i) Bus supervisor's office shall be provided at the Transfer Stations as indicated in Appendix A of this Part 4. The bus supervisor's office shall have the following requirements:

A. Shall be located at bus Platform level, within the Station;

B. Shall be located adjacent to the bus transfer Platform and contain a line of Site to monitor bus operations.

C. Shall be have a minimum area of $12m^2$ with no side less than 3m;

D. Shall be conditioned;

E. Shall be accessed from the bus Platform area;

F. Shall be equipped with a minimum of two data and two telephone connections; and,

G. Shall be provided with two operable windows.

(d) Public Parking:

(i) Park and Ride Facilities shall be provided at Leitrim and Bowesville Stations.

(ii) All Park and Ride Facilities shall be designed and constructed as follows:

A. Vehicle parking spaces:

i. Shall be between 2.6m to 2.75m wide;

ii. Surface lot parking spaces shall be 90 degree;

iii. A maximum of 5% of parking spaces located in each Park and Ride lot is permitted to be reduced to a width of 2.4m provided the spaces are clearly signed for compact cars only; and the resulting area difference between standard and compact vehicle parking space, shall result in an increase in total parking vehicle spaces by the equivalent vehicles area difference.

iv. Reduction of in width permitted in City of Ottawa Zoning By-law, Parking Space Provisions (Sec. 106) subsection (3) shall not be applicable to this Project.

v. Shall be 5.2m in length, except for parallel parking spaces which shall have a minimum length of 6.7m;

vi. Each Park and Ride lot shall have 0.5% of the initial parking spaces with provisions for charging stations for plug in electric vehicles including the following:

1 Power conduits, handholes, etc., including a dedicated 208/240V,50A circuit for each charging station;

2 Conduits, handholes, etc., for data and communications connection to each charging station;

3 Foundation and concrete slab for each charging station; and,

4 Identification and operating signage for each charging station.

B. Drive aisles:

i. Drive aisle within the parking area shall be a minimum of 6.7m wide.

C. Designated and dedicated area for snow storage requirement in accordance with City Standards including the OC Transpo Transitway and Station Design Guideline.

2.7 Project Elements

(a) Project Co shall design and construct Train Platforms in accordance with the following:

(i) Platform Height

A. The finished level of the Platform at Platform edge shall be level with finished floor height of the vehicle.

(ii) Platform Drainage

A. The cross slopes of the Platforms shall not exceed 2% with a minimum of 1% toward the Track or away from the Track.

B. The longitudinal cross slope of the Platform surface shall not exceed 1.5%.

C. The path of travel lanes on the Platform shall comply with OBC, NFPA and all accessibility requirements.

D. Snow removal:

i. Storage of snow on the Train Platform surface shall not be permitted.

(iii) Service Outlets

A. Service outlets for power and water shall be as follows:

i. Electrical – provide 15 A/120 V split receptacles at 20m intervals along the Platform area and one receptacle in each TSA; and,

ii. Water Hose Bibs – at a minimum provide one tamper proof hose bib on each Platform:

1 Water hose bibs shall be designed, located, and selected as to be protected from freezing.

(iv) Service/Maintenance Personnel Access Requirements

A. Project Co shall provide access from the Platform to Track level at each end of each Station Platform. Access off of the end of the Platform shall be restricted by gate with latch and fencing. Gate shall be signed and alarmed to prevent unauthorized access. Gate status shall be monitored by the TOCC.

(v) Platform barriers:

A. All side Platform configured Stations shall be provided with a continuous intertrack barrier fence between Tracks.

i. Barrier type shall be 1960mm high from top of Track, and be of premanufactured galvanized or powder coated steel construction.

ii. The barrier shall extend a minimum of 15m beyond the end of the Station Platform at each end of the Station.

iii. The barrier shall be non-climbable and designed to allow visibility from Platform to Platform.

iv. A gap of no more than 100mm between the bottom of the barrier and the surface below, (ballast, concrete, etc.) shall be permitted.

(vi) Inter-car barrier protection on all Platforms, except Airport and Uplands Stations, as follows:

A. Comprised of flexible bollards spaced as required to provide a clear distance between bollards that is not greater the 200mm;

B. Centred on the coupling of any two car Train;

C. Minimum length of 6.0m;

D. Located within the detectable Platform edge warning tile;

E. No less than 900mm above the Platform finish floor level;

F. Color shall be safety yellow; and,

G. The Platform design shall not prohibit the future installation of an inter-car barrier system at Airport and Uplands Stations.

(vii) All Platform floor finishes shall meet the following requirements:

A. The finished floor material shall have a non-slip surface with a coefficient of at least 0.60.

B. All Platform edges adjacent to Tracks shall have a cane-detectable, tactile warning strip, 610mm wide, extending full length of the Platform comprised of a non-slip, yellow surface.

C. Platform floor shall have a minimum 70% contrast in colour and texture from the flooring in the areas approaching the Platform.

D. The height of all Station Platforms above top of rail shall be 574mm such that a maximum vertical height difference of +16mm and -16mm is maintained to the Revenue Vehicles at all times.

E. The horizontal gap between the finished Platform and the Revenue Vehicles entrance shall be a nominal 50mm and to a maximum of 76mm at all times during boarding and alighting of Passengers.

F. The use of floor hatches and or floor access doors within the Platforms shall not be permitted.

G. Minimum 70 % colour-contrasting textured, non-slip tile wayfinding paths shall be provided to help locate vertical circulation elements by providing tile paths down the centre of the Platforms to the bases of stairs, and elevators.

i. Paths shall include all standard Transecure demarcations at the TSA.

(b) Project Co shall design and construct fare collection and control in accordance with the following:

(i) Project Co shall plan, design and construct all Stations with all power and communications conduit and Utilities provisions for installation of a fare control system including fare control gates and Ticket Machines to be supplied and installed by the City.

A. Fare control equipment provisions and requirements do not apply to existing Stations, (Bayview, Carling, Carleton, Mooney's Bay, and Greenboro), where existing equipment is previously installed and not modified by Project Co.

B. Each entry shall be provided with a minimum of two standard fare gates, two wide fare gates and two Ticket Machines. The designated "accessible" gate shall always be the one on the left when entering the paid zone with the second wide gate at the other end of the array.

C. Each fare gate array shall be contiguous and not broken or obstructed by any other elements, including structural components within the fare array or surge space.

D. Project Co shall provide minimum clear working distances from the fare gate pedestals as follows:

i. When approaching the fare array from the non-fare paid side provide 130mm on the left side of the fare array to a wall, barrier, or obstructions of any kind.

ii. When approaching the fare array from the non-fare paid side provide a minimum of 475mm on the right side of the fare array a wall, barrier or obstructions of any kind.

iii. Barriers to delimit the Fare Paid Zone at the gate array shall be located in the center of the length of a gate array and installed perpendicular to the gate arrays.

iv. In addition to the clearance requirements above, Project Co shall provide space in the array for one addition of one fare gate in the future to the right of the gate array. This space shall be protected for by providing a 1.5m high glass barrier centred on the fare gate pedestal.

(ii) The following Table indicates the minimum quantities of fare collection and control equipment required at each Station subject to revision based on the Project Co's Station designs and Passenger modelling and approved by the City:

Expanded Trillium Line					
Station	No. of Station Entries *	Ticket Machines	Smartcard Enable Fare Gate		
			Regular Gate	Wide Gate	Total Fare Gates

Bayview**	**1**	**2**	2	2	**4**
Gladstone	**1**	**2**	4	2	**6**
Walkley	**1**	**2**	3	2	**5**
South Keys	**1**	**2**	2	2	**4**
Leitrim	**1**	**2**	3	2	**5**
Bowesville	**1**	**2**	4	2	**6**
Limebank	**1**	**2**	2	2	**4**
Uplands	**1**	**2**	2	2	**4**
Airport***	**1**	**2**	0	4	**4**

** In the event that Project Co's Station design varies the number of entrances from the quantity indicated in the table above, the quantiles of fare control equipment shall be modified and approved by the City.*
*** For new entry only. Excludes the existing Station entries.*

**** Fare equipment provisions to be provided by OMCIA Passenger Terminal Building expansion project. Quantities indicated are for reference only.*

(iii) Project Co shall ensure that all building services and feeds are sized appropriately to accommodate the fare gate and collection equipment.

(iv) Project Co shall provide a 1.5m-high minimum glass barrier adjacent to the fare gate equipment and extending to a wall or other building element to provide protection of the Fare Paid Zone.

(v) Project Co shall plan and design the location of fare gate and collection equipment as to ensure the year round operation of the equipment by ensuring protection of the fare gate and collection equipment from direct precipitation, including wind-driven rain, snow, and sleet and drifting snow in accordance with clause 2.7(d)(iv)A. Fare vending equipment placement shall also mitigate glare from sunlight on the screen.

(vi) Project Co shall ensure consistent location of fare collection devices at Stations and in keeping with the Stations on the Existing Trillium Line and weather protection requirements.

(vii) Project Co shall ensure the integrity of the Fare Paid Zone at all Stations.

(viii) Project Co shall ensure all fare equipment located in public spaces shall be provided with overhead canopies to provide equipment and customers while using the equipment with weather protection.

(ix) Project Co shall design Stations fare collection equipment to be flush, fixed and integrated with Station infrastructure, unless otherwise noted, to avoid removal by unauthorized persons. In addition:

A. Project Co shall prepare all surfaces for installation of the fare collection equipment and system elements by the City's Fare Collection System provider.

B. Ticket Machine shall be installed to allow Ticket Machine doors to open 180 degrees for servicing. While in the open position the Ticket Machine door shall not preclude customers from using the second machine. Adjacent Ticket Machine s shall be separated by a minimum of 900mm.

C. Freestanding equipment shall be permitted provided Project Co ensures sufficient queuing and circulation space as well as space required for Maintenance and re-stocking activities, without compromising Passenger movement through the Station.

D. Project Co shall provide and install all conduit, cable ducts, and shall be concealed within walls, under slabs, within chases, etc., the use of exposed conduit and cable duct is prohibited in public spaces.

E. Within existing City structures, if the use of exposed conduit is required in public spaces for the installation of fare equipment, Project Co shall conceal conduits, etc. by painting, enclosing in chases or otherwise treating the conduits, junction boxes, cable ducts, etc. to blend in with the surface to which the item is attached.

F. Project Co shall provide the required supporting infrastructure, space, and Utility services provisions for power and communications connections, including but not limited to walker ducts and conduits:

i. Power shall be provided on an individual circuit per fare gate on UPS protected circuit, and with power being cut off by the fire alarm; and,

ii. Communication conduit from all fare equipment is to feed into communication room or communication cabinet.

G. Fare gates and Ticket Machines post installed anchor system require concrete embedment of 150mm. Project Co shall ensure location and or depth of concrete reinforcing is coordinated with the mounting requirements of the equipment ensuring there is no conflict between the anchor and reinforcing steel.

H. Project Co shall provide concrete mounting and walking surface at the fare control line between the floor grille assemblies, level with surrounding floor finish.

(x) Project Co shall provide CCTV coverage of the fare control equipment as follows:

A. Full CCTV coverage for inbound and outbound Passenger flows at the fare control line.

B. Full CCTV coverage of Ticket Machine and views of customer interactions with machines.

(xi) Project Co shall work in coordination with the City to ensure all supporting infrastructure and systems related to fare vending and control equipment have been accommodated and provide uninhabited access, and to ensure schedule coordination for equipment installation, testing and Commissioning with the City's fare control contractor, etc.

(c) Fare Paid Zone:

(i) Project Co shall plan, design and construct all Stations with segregated fare paid and non-Fare Paid Zones.

(ii) The Fare Paid Zone of the Station and all fare paid transfer areas shall be segregated from non-Fare Paid Zones by continuous 1.8m fencing or barrier.

(iii) Fare paid zones at Leitrim and Bowesville Stations shall be planned and designed to allow Passengers to transfer between bus and Train within the Fare Paid Zone of the Station.

(iv) The following additional requirements shall apply for bus Transfer Stations:

A. Fare paid transfer area of Stations shall be designed to prohibit transferring Passengers from crossing bus traffic;

B. All islands provided within a bus transfer area shall contain a combination of barriers not limited to fencing, landscaping, other physical elements to prevent Passengers from traversing bus traffic to access the Station and bus Platforms or other Passenger destinations;

C. Project Co shall provide an entrance to allow Passenger access to the bus Station area when the Train Station is secure during non-operational hour:.

i. The entrance shall be designed and constructed to be harmonious with the architectural design of the adjacent Train Station;

ii. Project Co shall provide signage and wayfinding for the entrance within the bus Station and from the public side;

iii. The entrance shall be secured with an overhead coiling grill monitored during Train non-operational hours; and,

iv. Notwithstanding requirements to secure the Train operations, Passengers shall have access to Ticket Machines during Train non-operational hours.

D. Project Co shall provide a minimum of three bicycle racks within the Fare Paid Zone of all Transitway/LRT transfer locations. As per Schedule 15-2, Part 6, Clause 2.7 (b) (vi), there shall be sufficient space to double the quantity of bicycle racks without modification to the built design.

(v) Project Co shall maintain the integrity of the Fare Paid Zone allowing Passengers to transfer between the Expanded Trillium Line and Confederation Line in the design of Bayview Station.

(d) Weather protection:

(i) Weather protection shall be provided via Platforms shelters and at Station entrances and waiting areas to provide Passengers with comfort and protection from inclement weather

conditions: rain, snow (and all other forms of precipitation), wind, heat, and UV protection.

A. Canopies at Station entrances shall be integrated with the Station.

B. Canopies shall be provided on façades of Station entrances facing streets.

(ii) Station elements and associated Facilities shall accommodate the operational demands of the Expanded Trillium Line, be compatible with the surrounding environment, and minimize the distance between Station entrance/egress points.

(iii) Where bus stops are located directly adjacent to a Station outside of the Fare Paid Zone, the position of the Station entrance/egress points shall allow direct access to and from the Station.

(iv) Fare Control requirements:

A. All fare gates shall be weather protected from rain infiltration and snow accumulation at fare gates in accordance with the following:

i. Project Co shall design the Station entries to limit exposure of the fare gates to direct precipitation in the form of rain and wind blown rain to 1.1% (95 hours) of the hours in a year; and,

ii. Project Co shall design the Station entries to limit exposure of the fare gates to direct precipitation in the form of snow to 6.1% (265 hours) of the total hours between October 15 to April 15 months;

B. Project Co shall conduct microclimate studies for each new Station entrance confirming compliance with the requirements of clause 2.7(d)(iv)A. In addition,

i. The microclimate studies shall be based on the last 30 years of historical climatic data available for the City of Ottawa;

ii. Each entrance/fare line shall be assessed using desktop computer simulation to ensure compliance with the Project requirements, unless otherwise agreed to by the City;

iii. Existing fare control Structures that are modified by Project Co shall be subject to the requirements of clause 2.7(d)(iv)A; and,

iv. Project Co shall validate the values required by clause 2.7(d)(iv)A for each entrance of each Station by computer simulation and shall submit the findings of the micro climate simulation in accordance with Schedule 10, as part of the Works Submittal for each Station.

C. Project Co shall be responsible to implement any required design changes as a result of the findings of the microclimate studies for each required submission. For further clarity:

i. In the event that Project Co makes modifications to any entry design following the submission of the final micro climate study, Project Co, at no cost to the City and without schedule impact, shall resubmit the microclimate study for the affected Station to ensure conformance with the requirements of clause 2.7(d)(iv)A. Should the study indicate nonconformance with the requirements, Project Co shall redesign and repeat the process until conformance with clause 2.7(d)(iv)A is confirmed.

(v) Clear minimum heights:

A. Clear minimum heights at Concourse Level shall be:

i. 3000mm from top of finished Concourse Level at Stations to underside of all suspended elements, including signage; and,

ii. 3500mm from top of finished Concourse Level to underside of ceiling at Stations.

B. Clear minimum heights at Platforms shall be:

i. 2700mm from top of finished Platform Level at Stations, excluding Passenger waiting shelters, to underside of all suspended elements, including signage;

ii. 4400mm from top of Track to underside of ceiling at Stations where Vehicles operate only, and 6706mm where freight train vehicle clearances are protected for; and,

iii. 4500mm from top of Track to underside of structure at Stations where Vehicles operate only, and 6706mm where freight train vehicle clearances are protected for.

C. Clear minimum heights at Station entrances shall be:

i. 4000mm from top of finished Station entrance level to underside of ceiling at Stations; and,

ii. 3000mm from top of finished floor to underside of all suspended elements, including signage.

(vi) Roof design features shall include, but are not limited to the following:

A. Skylights to allow natural daylight to reach the Platform surface.

B. Roof accessibility systems such as hatches and retractable ladders, for cleaning and Maintenance if required.

C. Fall protection measures that form a permanent part of the roof Structure.

D. Heat traced gutters and downspouts for roof drainage tied directly into a SWM system.

E. Snow guards shall be provided on all roofs where roof design contributes to possibility of falling snow and ice.

i. Project Co shall be responsible for the design of snow guard systems.

ii. Particular attention shall be paid to the design and placement of snow guards on areas of roof above Station entrances and areas of roof adjacent to spaces of public circulation or gathering such as sidewalks and bus Platforms to ensure the protection of the public from falling snow and ice.

(vii) Roof requirements:

A. Roof structures shall cover all vertical circulation elements (stairs and ramps within the Stations, stairs and ramps providing access to the Stations outside of the Fare Paid Zone and elevators);

i. Where Emergency egress only stairs or ramps are provided with heat tracing controlled by temperature and moisture detection, weather protection elements including roof coverage shall not be required.

B. Project Co shall be responsible for all interfaces and implications of the Platform roof structure, including the following:

i. Interface of roof structure with Train;

ii. Integration of lighting and signage requirements: and,

iii. Integration of any other Station or systems element.

C. Any and all roof top equipment shall be completely screened from all public areas, inclusive of views from within the Project Lands and all surrounding areas and within in the Station.

(e) Shelters:

(i) Shelters on Platforms shall be placed adjacent and parallel to the Platform edge, to provide clear Platform area for circulation, sized according to accommodate Passenger activity and shall provide clear sightlines of incoming Trains and buses, and to be approved by the City.

(ii) Equipment, furniture, signage, lighting, amenities, and other elements shall be integrated into the shelter structure.

(iii) Shelter panels for weather protection shall be transparent tempered glass, and graffiti-resistant.

(iv) Shelter side panels shall be of sufficient transparency to provide maximum visual surveillance of the Platform area to discourage vandalism and increase Passenger safety, to meet CPTED requirements.

(v) Project Co shall plan for Platform shelters to be located on the Station Platforms as follows:

A. Project Co shall provide OC Transpo shelters on all Platforms.

i. One shelter per Train Platform per direction shall be a TSA meeting the requirements per this Article:

ii. A reduction in the number of required shelters on Train Platforms is permitted provided alternative means of equivalent sizes, functions and weather protection is included on the Platform:

iii. On bus Platforms, Project Co shall provide and install a minimum of one bus shelter as per OC Transpo specifications, at each bus stop location as indicated in Appendix A of this Part 4, including power and communications provisions for City provided PIDS; and,

iv. Project Co shall remove existing shelters located on the existing Train Platforms, install the shelters as follows:

1 Project Co shall install nine shelters at Limebank Station as per Appendix B of this Part 4;

2 Project Co shall install one shelter at Walkley Station per Appendix B of this Part 4; and,

3 Project Co shall be responsible for the removal, storage and installation of all existing shelters to be repurposed and responsible to make good for all damage incurred prior to turn over to the City.

B. Project Co shall provide on demand Passenger radiant heating system in all TSA shelters on each Train Platform and the TSA shelter on bus Platforms. Radiant heating element shall equal the shelter length.

C. All new non-TSA shelters shall be equipped with the following:

i. Rough in for a minimum of 2 doors with power door actuators;

ii. Lighting, according to the Transitway and Stations Design Manual;

iii. Benches that comply with COADS/AODA;

iv. Transit Information Panel; and,

v. All shelters shall be provided with rough in and provisions for future installation of radiant heaters.

(vi) Project Co shall provide on street bus Facilities in accordance with Appendix B to this Part 4.

(vii) Project Co shall provide shelters on Train Platforms per the following:

Station	Northbound or Single Side Platform			Southbound Platform			Total # of New Shelters	Notes
	# of New TSA Shelters	# of New Standard Shelters	# of Ex'g Standard Shelters	# of New TSA Shelters	# of New Standard Shelters	# of Ex'g Standard Shelters		
Bayview	1	-	-	1	1	-	3	-
Gladstone	1	1	-	1	1	-	4	-
Carling	1	2	2	-	-	-	3	Existing Shelters to be relocated
Carleton	1	3	2	1	3	2	4	Existing Shelters to be relocated
Mooney's Bay	1	-	2	-	-	-	1	Existing Shelters to be relocated
Walkley	1	1	-	-	-	-	2	-
Greenboro	1	-	2	-	-	-	1	Existing Shelters to be relocated
South Keys	1	-	-	-	-	-	1	-
Leitrim	1	2	-	1	-	-	4	-
Bowesville	1	2	-	1	-	-	4	-
Limebank	1	1	-	-	-	-	2	
Uplands	1	1	-	1	-	-	3	-
Airport	1	-	-	-	-	-	1	Standard shelter not required due to integration with Airport Terminal building
Total	**12**	**8**	**8**	**6**	**3**	**2**	**39**	

Table notes:

1. Project Co shall design and provide rough in for a minimum of four shelters inclusive of the TSA on all Train Platforms with the exception of Bayview "southbound" (existing) Platform, Uplands and Airport Platforms which shall have only the number of shelters provided per the table and South Keys which shall have rough in for one shelter in addition to the TSA shelter.

2. In the event Project Co's Platform design results in a different configuration, Project Co shall consult with the City to confirm the number and types of shelters required at each Station and Platform.

3. Where shelter quantities are listed per direction, Project Co shall design the Station in either a two side Platform or a center Platform configuration.

(f) Transecure Areas:

(i) Project Co shall provide one TSA at all individual Station Platforms, including connecting bus Platforms.

(ii) On Train Platforms, the TSA shall be located near the centre of the Platform length to align with the door of a car in both a one or two-car consist Train operation.

(iii) TSA's shall be provided with the following features:

A. Signage indicating location of TSAs and indicating the amenities available in the TSA, which shall be consistent at all Stations;

B. Each TSA shall have fixed CCTV security coverage with a minimum of 2 cameras, PTZ cameras shall not be used for TSA;

C. Enhanced lighting level of 220 lux;

D. Transit information panels that show scheduled times, maps, and other relevant information shall be included;

E. A clock integrated with the TIPs shall be viewable from the TSA;

F. Companion seating;

G. Emergency phones at accessible height with handles, braille, and user-friendly directions;

H. Emergency cabinet with fire extinguisher;

I. Infrastructure conduit, and associated structural element to support/mount a pay phone;

J. Accessible seating for four including seating with handles and backs;

K. Tinted glass or anything that compromises safety or sightlines shall be prohibited from use in the TSAs;

L. Garbage and recycling receptacles shall be provided adjacent to the TSA;

M. All TSA Train Platform and bus Platform shelters shall be provided with timed, Passenger activated heating;

N. Project Co shall design and provide tactile wayfinding on the Platform floor surface to the TSAs shelter and from TSAs to the Platform edge;

O. All TSAs shall be fully enclosed and equipped with two accessible doors outfitted with power operated push button operators;

P. Be equipped with a floor drain inside the enclosure; and,

Q. Provisions for AED equipment as follows:

i. Space for an AED cabinet, size to be coordinated with the City during the design phase of the contract;

ii. Project Co shall provide electrical rough in for AED charging and AED cabinet heater; and,

iii. Project Co shall provide SCADA rough in for monitoring the AED and AED cabinet. AED shall be monitored at the TOCC.

(g) Station Entrances

(i) Entries for use by the public shall be equipped with a Maintenance access and exit door, and rolling grilles or ornamental gates or other means to secure the Station buildings during hours of non-operation in accordance with clause 2.5 (f) of this Part 4.

A. All doors, inclusive of coiling grilles shall be capable of being remotely opened, closed and locked from the TOCC;

B. The status of all doors shall be remotely monitored by the TOCC; and,

C. The Maintenance access door shall lead to the Fare Paid Zone. No Maintenance equipment shall enter the Station via the fare gates.

(ii) Where doors are provided at Station entries, the entries shall have at least one set of accessible, double, automatic sliding glass entrance doors with full-width entry mats with drainage pans, or one pair of power operated swing doors.

(iii) Each mode of transportation at Transfer Stations shall be capable of being secured separately when hours of operation differ.

A. Public access to/from the bus station at Transfer Stations shall be maintained 24 hours per day.

B. Bus Passengers shall have access to Ticket Machines during bus operating hours.

(iv) All doors, rolling grilles, etc. used to secure the Stations shall be equipped with electric operators, and controlled both locally and remotely from the TOCC.

(v) Project Co shall coordinate the exiting requirements and lock down of Station entrance from the Airport Passenger Terminal Building with OMCIAA at Airport Station during the design development stage.

(h) Project Co shall provide service areas at Stations as follows:

(i) Ensure that the service areas do not interfere with traffic patterns or normal operations

(ii) Lay-out of equipment rooms shall facilitate removal and replacement of equipment.

(iii) Project Co shall determine the necessity and scope for all service spaces required to operate the Stations beyond the Operator spaces and other required spaces identified in the Project Agreement. In addition:

A. Project Co shall not be restricted from utilizing mechanical, communication, and electrical equipment cabinets or from locating on Platforms. If located on Platform they shall be located at ends of Platforms only, provided there is no reduction in the Platform level of service, or impede snow removal and storage operations, or cause restriction on the clear sight lines of oncoming Trains, and in accordance with CPTED principles. They can be located adjacent to the Platform,

B. All equipment cabinets located on the Platform or located within the Fare Paid Zone and accessible to Passengers shall be of stainless steel construction.

(iv) All Stations with the exception of Bayview and Airport shall be designed for the connection of truck-mounted emergency generator(s). Refer to Article 6 – Electrical Design Criteria, of this Part 4 for additional information regarding emergency power/generator requirements.

(i) Advertising:

(i) Project Co shall provide all infrastructure to support advertising in the Stations, including power, data communications to support digital advertising;

(ii) Each advertising location shall be provided with lighting in accordance with IESNA standards to illuminate static advertising;

(iii) Each Station shall have a minimum of three locations for advertising within the Fare Paid Zone, with dedicated wall areas of 1.5m x 2.5m minimum; and,

(iv) Location and type of advertising shall be coordinated with the City during design.

(j) Project Co shall provide Public washroom features as follows:

(i) Fixed CCTV coverage of the exterior of the washroom entrance doorway of each washroom.

(ii) Each public washroom shall provide infant changing facilities in each public washroom.

(iii) Ceiling hung, embossed stainless steel panel, toilet partitioning.

(iv) Surface mounted, dead bolt type toilet stall hatch.

(v) Coat hooks on the stall door above head level.

(vi) Graffiti-resistant mirrors at each wash basin.

(vii) Soap dispensers, toilet tissue dispensers, towel dispensers and disposal units.

(viii) Wash basins built into a counter or vanity.

(ix) Project Co shall use industry standards and practices to heat and ventilate public washrooms without doors or with doors in the open position during winter design conditions.

(x) Vandal-proof fixtures shall be equipped with automatic water controls.

(xi) Toilet compartments and cubicles door and partition thickness: a minimum of 25mm; pilaster thickness: a minimum of 32mm.

A. No system shall contain material capable of supporting growth of bacteria, fungi, mould, etc. or encourage the harbourage of insects or mites. No system shall, to any appreciable degree, develop or shed electrostatic charges.

B. All fasteners shall be concealed or tamper proof.

(i) Entrances to washrooms shall be designed according to CPTED principles with a labyrinth style access.

(k) CCTV

(i) Project Co shall provide full CCTV camera coverage and associated systems performance for Stations and Facilities as follows:

A. As indicated elsewhere in this Part 4;

B. All public spaces shall have CCTV coverage, excluding washrooms;

C. Entrances to Maintenance access areas;

D. Train Station Plazas and Train Station exteriors;

E. Bus Facilities at Transfer Stations;

F. Bicycle parking;

G. Park and Rides;

H. Entrances to Stations; and,

I. Elevators, and all stairs runs and landings.

(l) Emergency phones:

(i) Project Co shall provide Emergency phones providing direct audio connection to the TOCC as follows.

A. Provide one Emergency phone at each entrance on non-fare paid side, and in general Passenger circulation area;

B. Provide a minimum of two Emergency phones on each Train Platform;

i. Shall be spaced a no more than 30m;

C. In addition to the Emergency phones required on Platforms each TSA shall have an Emergency phone;

D. Provide Emergency phones spaced not more than 50m in any direction in surface Park and Ride facilities;

E. Provide Emergency phones at 30m apart on all bus Platforms, in addition to the Emergency phone at the TSA;

F. Provide Emergency phones along isolated pathways, underpasses or breezeway; and,

G. Provide Emergency phones at new designated PPUDO.

(ii) Provide Emergency phones at outdoor locations. Emergency phones shall be identified with a blue marker light.

(m) Payphones:

(i) Project Co shall provide provisions for public pay phones in accordance with the following:

A. Provide conduit and space for one pay phone at every bus and Train Platform in addition to the payphone required in the TSA;

B. Provide conduit and space for one payphone in each TSA;

C. Provide conduit and space for pay phones at new PPUDOs;

D. All designated space and public phones shall be fully accessible; and,

E. The City will arrange with a Third Party Contractor for payphone installation and Maintenance of public payphones.

(n) Transit Information Panels:

(i) Project Co shall provide TIPs as follows:

A. Provide two TIPs on each Train Platform in a side Platform configuration, excluding TIPs located within the TSAs;

B. Provide four TIPs on each Train Platform in a centre Platform configuration, excluding TIPs located within the TSAs;

C. Provide two TIPs at each Station entry prior to the fare gate, located outside of the fare paid area:

i. Shall be accessible 24/7 when Station is closed;

D. Provide at a minimum one TIP, located after the fare gate, inside the Fare Paid Zone, excluding TIPs located on Platforms and at the TSAs. Where a Station has two or more entrances, where Passenger traffic does not converge before accessing the Platform Level, provide TIPs inside the Fare Paid Zone at each entry;

E. Provide a minimum of one TIP in each bus shelter;

F. Provide one TIP in each TSA located on bus and Train Platforms;

G. TIP panel size (1.2m x 1.3m) shall be confirmed during design phase; and,

H. All TIPs shall be backlit.

(ii) Project Co shall equip each shelter in a bus Station with one TIP.

(o) Project Co shall provide clocks displaying time of day connected to the NTP server, with a minimum of one clock per Platform, including bus Platforms at Terminal/Transfer Stations.

(i) Project Co shall provide clocks meeting the following minimum requirements:

A. Including digital LED display;

B. Capable of full operation in an outdoor environment, exposed to the elements in a dry bulb temperature range of -40°C to 40°C;

C. Capable of displaying both time and date simultaneously as follows:

i. Capable of displaying 12:00 or 24:00 hour time in hours mins and seconds, with the option to configure with or without seconds being displayed;

ii. Capable of displaying date in varying formats and sizes, maximum character height shall be no greater than that of the time display; and,

iii. Capable of displaying time independently with or without date being displayed.

D. Minimum cap character height for time display of 150mm;

E. Have amber character colour and background with a minimum colour contrast of 70%. Amber colour shall be consistent with amber colour utilized in the PIDS; and,

F. Clock display shall meet or exceed all accessibility requirements referenced in this Part 4.

(p) Trash and recycling receptacles:

(i) Project Co shall provide trash and recycling receptacles in the following locations and minimum quantities:

A. Three on each Platform including one located at the TSA except at Airport and Uplands Stations;

i. Project Co shall provide two trash and recycling receptacles on each Train Platform including one located at the TSA at Airport and Uplands Stations.

B. One located on each mezzanine or Concourse Level of the Station;

C. All receptacles provided in public spaces shall be transparent to allow visual identification of their contents;

D. Where provided, all receptacle groups shall be four stream receptacles to separate at source; organics, paper, glass, metal and other refuse; and,

E. Receptacles shall not be integrated into cabinets with other customer amenities such as TIPS or Emergency phones.

(q) Platform seating:

(i) Project Co shall provide three benches that can accommodate three Passengers per bench seating on each Train Platform per direction except at Airport and Uplands Stations;

A. Project Co shall provide one bench that can accommodate three Passengers per bench seating on each Train Platform at Airport and Uplands Stations in addition to the TSA.

(ii) Project Co shall provide seating for three on each bus Platform for every two bus bays at Terminal/Transfer Stations;

A. Bench locations shall be coordinated with the City and shall not impede snow removal equipment movement and pedestrian flow.

(iii) Armrests and backrests shall be provided on all benches and designed according to AODA standards, and,

(iv) The location of Platform seating shall not interfere with access to overhead lighting and equipment.

(r) Project Co shall provide PIDS as follows:

(i) Train Platform/Concourse PIDS

A. Project Co shall provide PIDS signs to provide up-to-date, specific, real time, location-based, visual operational and safety-related messages for customer awareness in all Stations.

B. PIDS shall be provided in all Stations, in locations and quantities including, but not limited to:

i. Two PIDS at all Station Platforms;

ii. One PID at each Station level with a fare line, and as required at end of Line Stations;

iii. PIDS shall be visible and readable form both the unpaid and paid sides of the fare line; and,

iv. All PIDS shall be double sided except where flush mounted on a wall.

C. PIDS shall be individually addressable and shall be accessed from the existing PA/PIDS console located in the TOCC. Under normal operating conditions, information presented on the PIDS shall include, but not be limited to, date, time, minimum next three arrival time and destination of the next Train (one arrival time per line); safety messages; Train delays; holiday schedules; and other ad-hoc messaging. In an Emergency condition, the PIDS shall display both pre-programmed Emergency announcements and simultaneous visual display of the PA system Emergency announcements. Refer to Schedule 15-2, Part 3, Article 4 - Public Address System/Passenger Information Display System, for additional requirements.

(ii) Nexus/Directory/PIDS

A. Project Co shall coordinate, design, construct and equip each Station with the structural, mechanical, electrical and communications infrastructure provisions to support the installation of City supplied PIDS and enclosures. Project Co shall identify designated locations including, but not limited to, one PID at the concourse level of each Station; one PID at the nexus points between modes at Transfer Stations; one PID outside each fare gate; one PID at each bus Platform entrance; and one PID at each after hours entrance.

B. The locations shall be incorporated into the Station design with consideration given to: mounting surfaces, sightlines, wayfinding, accessibility, vandalism, and security.

C. Project Co shall coordinate and supply required infrastructure at these locations including: power and communications requirements, blocking within walls, ceiling structure, or posts as required and identified by the City.

D. The City will provide and install the required PID components including enclosures and mounting hardware.

E. PIDS at these locations will be operated using a City-supplied application and software controlled through the City network.

F. PIDS at these locations will be maintained by the City.

(iii) Bus Station PIDS

A. Project Co shall equip each bus Station with provisions to support the installation of City supplied PIDS and enclosures. Project Co shall identify designated locations including; one PID for each shelter, one PID at each bus stop Platform, one PID on each bus Platform centrally located at the entrance to the Train portion of the Station and shall allow for viewing from either side of PID.

B. Locations shall be incorporated into the Station designs considering: mounting surfaces, sightlines, wayfinding, accessibility, vandalism, and security.

C. Project Co shall coordinate and supply required infrastructure at these locations including: power and communications requirements, blocking within walls, ceiling structure, or posts as required and identified by the City.

D. The City will provide and install the required PID components including enclosures and mounting hardware.

E. PIDS at these locations will be operated using a City-supplied application and software through the City network.

F. PIDS at these locations will be maintained by the City.

(s) Algonquin wayfinding wheel

(i) At each Station, an Algonquin wayfinding wheel shall be installed at either the entry, concourse, Platform or Station Plaza;

A. The City will be responsible for the production of the wayfinding wheel for each Station.

B. Project Co shall incorporate the wayfinding wheel into the design and shall be responsible for the installation and placement of this element in accordance with guidelines and standards provided by the City.

C. The location of the wayfinding wheel at each station shall be co-ordinated with the City through the design review process.

D. The City will undertake consultation with the appropriate Aboriginal representatives, (including the Algonquins of Ontario) during the design stage to ensure cultural appropriateness of the location of the Algonquin wayfinding wheel and provide this input to Project Co for incorporation into Project Co's design.

(t) Public Art

(i) Project Co shall support the City in implementing a digital art program at South Keys, Gladstone and Bowesville Stations, including, but not limited to, participation in

technical review for art project proposals, acting in an advisory role to the artwork selection jury and necessary coordination for installation of selected art projects.

(ii) Project Co shall provide power and data in support of the digital art program including rack space as outlined in Schedule 15-2, Part 3, clause 4.6.

(iii) The final power and data connection locations shall be determined during the design phase in co-ordination with the City. Stations and locations of Public Art shall be as follows:

A. Project Co shall provide power and data infrastructure at South Keys Station as follows:

i. At the west fare controlled entrance plaza;

ii. On the Platform to support a potential free-standing installation to be provided by City artwork;

iii. Between the rail and the Transitway; and,

iv. Within the new underground portion of the Station connecting to the Transitway Structure.

B. Project Co shall provide power and data infrastructure at Gladstone Station as follows:

i. On each the northbound and southbound Platforms; and,

ii. A minimum of two locations within the new Station Plaza.

C. Project Co shall provide power and data infrastructure at Bowesville Station as follows:

i. At the new Station Plaza; and,

ii. On the primary Train Platform.

2.8 Materials

(a) Materials used for the construction of Stations shall be low VOC and contain recycled content to the maximum extent possible where not specified below:

(i) Cast in Place Concrete:

A. Provide steel materials with postconsumer recycled content of not less than 60%.

(ii) Precast Concrete:

A. Provide steel materials with postconsumer recycled content of not less than 60%.

(iii) Architecturally exposed structural steel:

A. Provide steel materials with postconsumer recycled content of not less than 25%.

B. AESS shall conform to CISC Code of Standard Practice for Structural Steel, APPENDIX I, as supplemented by CISC Guide for Specifying Architecturally Exposed Structural.

C. All structural steel exposed to public view shall be AESS as follows:

i. Exposed structural steel that is 6m or greater measured vertically or horizontally from a walking surface and is visible to a person standing on that walking surface shall be Category 2 AESS; and,

ii. Exposed structural steel that is less than 6m measured vertically or horizontally from a walking surface and is visible to a person standing on that walking surface shall be Category 3 AESS.

D. All exposed structural steel shall be finished with a high performance coating.

(iv) Painted metal fabrications:

A. Provide steel materials with postconsumer recycled content of not less than 25%.

(v) Stainless steel fabrications:

A. Provide steel materials with postconsumer recycled content of not less than 25%.

B. Where finish quality may be compromised by the percentage of postconsumer recycled content, provide materials with the maximum postconsumer recycled content acceptable to the selected manufacturer.

(vi) Aluminum materials:

A. Aluminum curtainwall skylights systems:

i. Provide aluminum materials with postconsumer recycled content of not less than 50%.

B. Aluminum extrusions fabrications, etc.:

i. Provide aluminum materials with postconsumer recycled content of not less than 25%.

(vii) Glazing:

i. Provide glass products with postconsumer recycled content of not less than 25%.

ii. Sealants used inside of the weatherproofing system protecting interior spaces shall have a VOC content of not more than 100 g/L.

(viii) Overhead coiling grilles:

A. Where used to secure Station entrances and to secure bus Platforms from Train Platforms, coiling grilles shall be as follows:

i. Curtain Material: Stainless steel, ASTM A666, Type 316.

ii. Curtain consisting of a network of minimum, 8mm diameter horizontal rods, or rods covered with tube spacers.

iii. Bottom Bar: Stainless Steel tube, finished to match grille.

iv. Grille Curtain Jamb Guides: Stainless steel angles with stainless steel mounting brackets.

v. Each grille shall be equipped with an electric operator

vi. Operator shall be controlled both locally and remotely from the TOCC

B. Shall have manual operation device for use in the event of motor failure or power outage and shall:

i. Provide connection for off-site remote control by TOCC.

ii. Provide a Safety edge located at grille bottom bar, full width, electro mechanical pneumatic sensitized type, wired to immediately stop grille upon striking object, and reverse downward grille travel, with a hollow covered seal.

(ix) Graffiti-resistant

A. Graffiti-resistant coating to be applied to all porous opaque surfaces including but not limited to concrete, masonry and stone up to a minimum 2.5m above adjacent floor/ ground or where surfaces are reachable to tag.

(x) Architectural cast in place concrete

A. All concrete left exposed as the final finish outside and within Stations shall be architectural, cast in place concrete.

i. Provide architectural cast in place concrete in accordance with CSA-A23.1/A23.2, 8.3 Architectural Concrete and ACI 347.3 Guide to Formed Concrete Surfaces, including proposed reference samples and mock-up field samples.

ii. Architectural Cast in Place Concrete Finishes.

iii. Finish: Smooth.

iv. Formed Concrete Surface: CSC3 as defined in ACI 347.3R, Table 3.1a – Description of formed concrete surfaces.

v. Colour: Light grey.

vi. Limit of Concrete Surface Irregularities.

vii. Consistent with CSC3 concrete surfaces per ACI 347.3R.

viii. Tie Holes: Uniform profile and diameter, in symmetrical layout, filled with plugs matching appearance of adjacent concrete.

B. Related Unformed Surfaces: Strike off smooth and finish with a texture matching adjacent formed surfaces, at tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces.

C. Mock-up field samples: Preconstruction mock-up field samples shall be made for each finish or shall incorporate all finishes proposed to be utilized, using equipment, materials, and procedures planned for the actual construction. The City shall examine the mock-up field samples and compare them with the reference samples prepared in accordance with CSA-A23.1/A23.2, clause 8.3.2 for approval prior to ordering formwork. The panels should be full-size to match the actual work as closely as possible. Additional samples shall be cast by Project Co to the satisfaction of the City to achieve the required matching. Mock-up panels shall be standalone elements and are prohibited from form permanent construction of any facility. The sample(s) shall serve as the standard for acceptance of the finished construction.

i. Construct field mock-ups using same procedures, equipment, and materials that will be used for production of architectural concrete. Accepted field mock-up shall serve as the reference to which architectural concrete will be compared for periodic and final acceptance. Construct field mock-ups at an acceptable location on Site.

ii. Provide a simulated repair area to demonstrate an acceptable repair procedure. Repair procedure shall provide an acceptable color and texture match. Protect from physical damage and retain mock-ups until final acceptance of architectural concrete.

iii. Construct a minimum 3m x 3m mock-up for Platforms, for review and acceptance using procedures detailed

D. Periodic acceptance

i. Project Co's architect shall periodically observe completed portions of architectural concrete for conformance with accepted field mock-up. The frequency of periodic acceptance and acceptance criteria shall include at a minimum, including but not limited to:

1 A minimum of one review of in place formwork prior to first placement of architectural concrete for a Station;

2 At a minimum the architect shall witness the first placement of architectural concrete in a Station; and,

3 At a minimum the architect shall be present for the removal of the formwork of the first architectural concrete pour and assessment of finish for a Station.

E. Patching and repair procedures:

i. Surface sacking or abrasive blasting to conceal surface imperfections shall not be permitted without prior approval from architect and City.

ii. Patching and repair procedures shall be prepared and submitted to the architect for review and approval, prior to submission to the City for the same.

(xi) Bird protection devices

A. Provide a system of bird control using devices to prevent pest birds from landing, roosting, nesting or climbing on horizontal surfaces at Stations, except for the roof exterior, tops of windscreens, light fixtures, security fences, handrails, guardrails, stone, and architectural concrete.

(xii) Ceiling material:

A. Project Co shall install ceiling material in the public area of all Stations with the exception of Bayview Station and Airport Station that is consistent with the material utilized in the existing Stations. The ceiling material shall be as follows:

i. Material shall be Longboard Siding and Soffit, manufactured by Mayne Coating Corporation or equal;

ii. Profile shall be 150mm V-groove prefinished extruded aluminum soffit with an integrated venting system and matching accessories; and,

iii. Material shall have alluminate bonded wood grain finish to match existing. Existing material finish is Light Cherry 1406/01-716.

(xiii) Floor grilles (applicable to new Station entries with fare control equipment)

A. Provide manufacturer's Heavy duty aluminum or stainless steel floor-grille assemblies, consisting of treads joined together by cross members, and with support legs and other components needed to produce a complete installation, including locking devices for each panel.

B. Shall be AODA, COADS, and CSA B651 compliant.

C. Frames: Manufacturer's standard frames, including perimeter frames, of size and style for grille type, for permanent recessed installation in floor, complete with installation anchorages and accessories, same material and finish as grilles. Provide concealed frameless supports except at perimeter frame.

ARTICLE 3 STATION SPECIFIC ARCHITECTURAL DESIGN CRITERIA

3.1 Introduction

(a) Project Co shall design and construct Stations in accordance with the requirements and scope particular to each individual Expanded Trillium Line Station within this Article.

3.2 Bayview Station

(a) Bayview Station is a Transfer Terminal Station being constructed as part of the City's Confederation Line project. Project Co is responsible for ascertaining all as-built conditions of Bayview Station. The existing Station Platform on the west side of the alignment shall remain in-place. An extension to this Platform with a minimum length of 77m to accommodate a Train shall be provided, as well as a second 77m minimum length Platform on the east side of the Station to allow Bayview to operate as a two-Track Station.

(b) Project Co shall be responsible for any and all modifications of the existing Station Platform to maintain the Platform gap specified in this Part 4.

(c) A partially enclosed glazed and secure corridor is required to provide a customer connection between the western and eastern Platforms. The materials and the architecture design and finishes of this corridor connection shall match the materials and architecture design and finishes of the as-built Station.

(d) The new Platform, Platform extension, public concourses, and entrances shall have perimeter windscreens per the Confederation Line Station design.

(e) A new PID indicating next Train arrival times on the eastern Platform near the existing vertical circulation shall be provided to direct customers on the correct Platform to wait for the next Train.

(f) Project Co shall provide a pedestrian Bridge, vertical circulation, a new fare controlled entrance and a new entrance plaza at the western Train Platform extension per the following:

(i) Project Co shall provide an entrance plaza and pathway connections to the existing pathway system. The entrance plaza shall serve both the new fare controlled entrance and the vertical circulation core of the pedestrian Bridge outside of the Fare Paid Zone;

(ii) The fare controlled entrance, vertical circulation and Bridge shall not be required to be detailed per the existing Bayview Station. It is acceptable to utilize a framed glazing system; however, the architectural language shall complement the existing Confederation Line Station;

(iii) The new entrance shall be directly accessible, meeting the requirements of AODA, COADS and CSA B-651, from the new plaza and to the Bridge vertical circulation core via a weather protected connection;

(iv) The Station entrance and the Bridge shall be secured independently to allow each element to function with one or the other secured;

(v) Project Co shall provide a fully enclosed non fare-paid pedestrian Bridge connection from the development at 900 Albert to the west Station Platform area:

A. Project Co shall coordinate the design and construction of the Bridge with the developer including the connection location, expansion joints, etc.;

B. The Bridge shall be designed to limit snow and ice from falling onto surfaces below the Structure;

C. The Bridge shall be provided with a glazing system that allows for glazing to be replaced from the inside of the Bridge;

D. The Bridge and vertical circulation core shall be ventilated in accordance with OBC and ASHRAE 62.1;

E. Project Co shall construct the Bridge to connect to 900 Albert Street at elevation 63.0. The centre of the Bridge connection point shall be geographically located at N 5030196.0542, E 365787.4679. The accuracy of the location shall be within +/- 150mm parallel to the property line;

F. The Bridge level shall be served by vertical circulation on the west side of the alignment consisting of stairs and two elevators;

G. All elements of the Bridge and vertical circulation core shall satisfy all minimum requirements of the Project Agreement;

H. The Bridge and Bridge support Structure shall have the following clearances from the previously relocated WNC at the east side of the site:

i. Vertical clearance from underside of Structure and any finishes, conduits, etc. to grade above the WNC shall be at a minimum 5.0m;

ii. All above grade Structural supports shall provide a minimum 5.0m clearance from the face of any new Structure to the exterior face of the WNC;

iii. No part of the Structure shall be within 5.0m of the WNC access shaft Structure to the north of the Bridge location;

iv. The Bridge Structure shall be designed and constructed in a manner not to impart any load on the previously relocated WNC;

I. The eastern most supporting Structure shall be located to allow the developer to install shoring on the City's property for the underground portion of 900 Albert Street. A minimum of 1.0 m west of the property line shall be available for this purpose; and,

J. Project Co shall design and construct the Bridge to be self-supporting and shall not impart any lateral or vertical load to 900 Albert Street structure.

K. The developer shall be responsible for the weather tight connection to the Bridge and 900 Albert Street including the expansion joint and expansion joint cover. Project Co shall coordinate the required width of the joint, not to exceed 300mm, and provide the appropriate substrate required to allow the installation of the joint between the Bridge and 900 Albert Street by the developer.

L. The Bridge, vertical circulation, and connection between the fare paid entry and point of connection at 900 Albert Street shall have full CCTV coverage;

M. The minimum inside clear width of the Bridge shall be no less than 4.0m measured between Structural supports and or railing system or glazing system support members; and,

N. The minimum inside clear height of the Bridge shall be no less than 3.5m measured between the finished floor level and the underside of the lowest element of either the finished ceiling material or structural member.

O. Project Co shall be responsible for provision of temporary barriers to prevent access to the Bridge by the public and temporary weather protection required to protect the end of the Bridge until such time as the Bridge connection becomes operational following the construction of the adjacent development.

(vi) All above grade building elements of the entry, Bridge and vertical circulation elements shall meet the minimum horizontal and vertical clearance requirements from the western most existing freight rail as required by Transport Canada's, Standards Respecting Railway Clearances, Diagram 1; and,

(vii) The Bridge shall have a minimum 5.3m of clearance from TOR to any element of the Bridge on both the northbound and southbound Expanded Trillium Line Tracks.

3.3 Gladstone Station

(a) Gladstone Station shall be a new Line Station located north of Gladstone Avenue.

(b) A single Station fare paid entrance shall be centred upon the alignment with a new Station Plaza integrated with the existing Gladstone Avenue Bridge. The Station entrance and façade shall be set back a minimum of 18.0m from the face of Gladstone Avenue curb measured at the centre of the alignment. No component of the Station structure with exception of a roof overhang shall be within the setback distance.

(c) Project Co shall provide a new Station Plaza with a minimum area of 500 m^2. The required plaza area shall be measured from the curb face of Gladstone Avenue to the building entry and façade, and between the vertical face of the east and west Train alignment trench at the northern edge of the existing Roadway Bridge.

(d) Project Co shall segregate the eastern edge of the public plaza from the north-south MUP with landscape and urban design elements to prevent the mixing of pedestrian and cyclists in the plaza near the Station building. The elements creating the barrier for cyclists shall allow for the passage of pedestrians. The design shall provide a mixing zone for pedestrians and cyclists. Bicycle parking required as per Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, shall be provided at the east side of the plaza.

(e) Passenger Southbound Revenue Service Trains shall always use the western Track within the Station and northbound Revenue Service Trains shall always use the eastern Track within the Station.

(f) Design the Station Platform to protect for potential falling rocks from rock cut onto the Platform, and to discourage graffiti on the rock cut. Project Co shall keep the rock cut a minimum of 1m away from the Platform.

(g) Project Co shall include accommodation for snow storage from the Station Plaza.

(h) Project Co shall design and construct the Station to accommodate future overhead connections from development on both the east and west side of the alignment as follows:

(i) Station structure shall be designed to accommodate second floor loading:

A. The future second floor level shall be at 6.0m above the Station entry level.

(ii) Station vertical circulation elements, stairs and elevators shall be designed and constructed to allow for extension to the future second floor level. Vertical circulation elements shall be continuous from each Platform to the future second floor level.

(iii) The future second floor and vertical circulation shall be within the Fare Paid Zone:

A. Fare control equipment shall be located within the future development connections. Project Co shall size services capable of support the additional fare control equipment; and,

B. Shall provide pathways of adequate size capable of being extended to the upper level to support the fare control equipment.

(iv) Project Co Work Submittals shall indicate the locations and accommodations of the future connections.

(i) Project Co shall provide on street bus stop and shelter, as per Appendix B, and shall provide TWSI connecting the bus stop with the Station fare gates at the entrance.

(j) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

3.4 Carling Station

(a) Carling Station is an existing Line Station located north of Carling Avenue served by an entrance from the adjacent MUP to the east of the alignment.

(b) Project Co shall determine the extent of work associated with the existing Structure to satisfy the Design Life and Handback requirements defined in the Project Agreement.

(c) Project Co shall provide a new elevator serving the Station entrance and Station Platform. In addition to the new elevator, Project Co shall replace or refurbish the existing elevator and elevator equipment to satisfy the requirements set forth in this Part 4.

(i) All elevators shall be within the Fare Paid Zone.

(ii) If an additional Station entrance is required to meet elevator and Passenger flow requirements, Project Co shall design and construct entrance to accommodate fare control and requirements otherwise prescribed in this Part 4.

(d) Design and construction of the Station shall not preclude a future connection to the future hospital site, south of Carling Avenue.

(e) Project Co shall provide on street bus stop and shelter per Appendix B, and shall provide TWSI connecting the bus stop with the Station fare gates at the entrance.

(f) The Station has an existing fare paid entrance, which shall remain. Project Co shall be responsible for any design, construction or relocation modifications needed at the entrance enclosure.

3.5 Carleton Station

(a) Carleton Station is an existing Line Station with two Platforms serving Carleton University and surrounding areas. The Station is located between Campus Avenue and University Drive at the intersection of Campus Avenue and Library Road.

(b) The Station has two existing fare paid entrances one from the east and one from the west. The existing fare control enclosure shall remain. Project Co shall be responsible for any design, construction or relocation modifications needed at the entrance enclosure.

(c) If an additional Station entrance is required to meet Passenger flow requirements, Project Co shall design and construct the entrance to accommodate fare control and requirements otherwise prescribed in this Part 4.

(d) Project Co shall protect existing public art and including sight lines from both Platforms, to coordinate with the Public Art Program.

(e) Project Co shall provide a pedestrian underpass Structure north of the Station Platform. The pedestrian underpass Structure shall be designed and constructed as follows:

(i) The southern inside face of the pedestrian underpass shall be located between 13.5m and 15.0 m north of the northern end of the existing Platform end;

(ii) Project Co shall determine the final length of the Structure based on the following:

A. The Structure shall extend a minimum of 1.5m beyond the eastern and western outside edge of the existing Platform edge or 1.5m beyond new Platform extension edge;

B. The extent and construction of the Structure shall not prohibit the future construction of elevators and stairs leading to the east and west entries in the future; and,

C. The length of the Structure shall be sufficient as to allow for extension of the Structure and construction of stairs and elevators at a future date without interruption to Revenue Service.

(iii) The underpass Structure shall have a minimum clear width of 4.5m clear and a clear height of 3.5m;

A. Haunches of a concrete Structure not exceeding 600mm x 600mm shall be permitted within the clear opening;

(iv) The underpass Structure shall be designed and constructed to prevent the ingress of water; and,

(v) The east and west ends of the underpass Structure shall be designed and constructed to allow for extension in the future.

(vi) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

3.6 Mooney's Bay Station

(a) Mooney's Bay Station is an existing Line Station located south of Heron Road.

(b) The Station shall be served by one fare paid entrance located west of the alignment accessible from the adjacent MUP. The existing fare control enclosure shall remain. Project Co shall be responsible for any design, construction or relocation modifications needed at the entrance enclosure otherwise prescribed in this Part 4.

(c) Project Co shall design and construct Platform extension with all related shelters, and requirements.

3.7 Walkley Station

(a) Walkley Station shall be a new Line Station located south of Walkley Road adjacent to commercial property to the east.

(b) The Station entrance shall be located a minimum of 8m and no further than 20m from the northern side of the existing Walkley Road sidewalk to accommodate the Station Plaza.

(c) The fare paid entrance and Station Plaza shall be accessed directly from Walkley Road with the fare gates located at street level.

(d) Project Co shall provide stairs and elevators from the entrance to the Platform within the Fare Paid Zone.

(e) Project Co shall provide a combination of signage, architectural elements, and landscape features directly adjacent to Walkley Road to clearly announce the Station location from Walkley Road.

(f) Project Co shall design the Station not to preclude a future entrance from the MUP on the east side of the Station in the vicinity of the southern Platform emergency egress location.

3.8 Greenboro Station

(a) Greenboro Station is a Transfer Station on the Existing Trillium Line.

(b) Project Co shall protect existing public art and to coordinate with the Public Art Program.

(c) Project Co shall design and construct Platform extension with all related shelters, and requirements.

3.9 South Keys Station

(a) South Keys Station is an existing Transitway Station located adjacent to the South Keys Shopping Centre that Project Co shall expand to serve as a Transfer Station between the Airport Link and Expanded Trillium Line Trains.

(b) Project Co shall provide Platform canopy coverage in the form of an architectural roof to shelter the short-term layover Airport Link Passengers transferring to the Expanded Trillium Line Trains.

(c) Project Co shall design and construct the Station to allow for a non paid connection from the MUP west of the Expanded Trillium Line corridor to the existing Transitway entrance and through to the parking lot of the retail development to the east. Project Co shall not be required to expand the width of the existing Expanded Trillium Line Structure or modify the existing unless otherwise required by Applicable Law, (i.e. the OBC for exiting purposes). The non-fare paid connection shall be open to the public 24 hours per day, seven days a week from both the east and west entrances and allow the new Station Train Platform to be secured during Train non-Revenue Service Hours.

(d) Project Co shall provide a minimum of one fare paid entrance. The fare paid entrance shall be from the passageway connecting the MUP on the west side of the Expanded Trillium Line corridor to the existing Transitway entrance.

(e) Project Co shall design and construct a new pedestrian underpass Structure from the MUP on west side of the alignment to connect with the entry plaza and roadway on the east side of the Transitway.

(i) Project Co shall be responsible to construct only the portion of the Structure from the MUP on the west side of the alignment to a point east of the alignment. Project Co shall determine the eastern extent of the Structure as follows:

A. Eastern extent shall not impact the operations of the existing Transitway and Transitway Station operations during construction;

B. Eastern extent shall be as such to allow for the completion of the underpass Structure at a later date without interruption to Train Operations of the Trillium Line;

C. The pedestrian underpass shall be a minimum of 6.0m wide. The centreline of the new Structure shall be no greater than 33m north of the centreline of the existing tunnel Structure;

D. Project Co shall provide detailing to allow for underpass Structure to be extended east; and,

E. Project Co shall determine eastern termination methods.

(ii) Western extent of the pedestrian underpass Structure shall be secured to prevent unauthorized entry, but allow for inspection

(f) Project Co shall construct a new entrance plaza to serve the existing east Transitway entrance in accordance with Schedule 15-2 Part 6, Article 4.1(h) and as follows:

A. The Plaza design shall maintain fire route access from the east west access road to the cinema located south of the Station;

B. Shall maintain service vehicle access to businesses adjacent to the Transitway;

C. Shall maintain public vehicular access to the automotive service center located adjacent to the Transitway; and,

D. Shall protect for the future construction of a fare paid entrance as follows:

i. Fare paid entrance shall meet the minimum requirements for the installation of the minimum quantity of fare equipment, minimum queuing distances and maintenance access in accordance with this Part 4.

ii. The fare paid entrance shall accommodate a covered walkway connection to development to the south allowing for a continuous pedestrian covered connection with a minimum width of 7.0m; and,

iii. Protection for future works shall include providing the area of the entrance building and south of the entrance building, free of foundations, utilities, building services and building system elements that would otherwise prevent the construction of the future Structures without relocation.

(g) Project Co shall protect existing public art and to coordinate with the Public Art Program.

(h) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

3.10 Leitrim Station

(a) Leitrim Station is an existing bus Station and Park and Ride located south of Leitrim Road. The new Leitrim Station shall be a Line and Transfer Station with a Park and Ride Facility.

(b) The new Station shall have at a minimum one fare paid entrance with access to the Park and Ride Facility and PPUDO.

(c) The Station shall be designed and constructed to allow the bus Platform to remain accessible to the public while securing the Train Platform during Train non-Operating Hours.

(d) The Park and Ride Facility shall be designed and constructed to accommodate initial capacity and design allowance for ultimate capacity configuration. Project Co shall design the initial and full buildout of the Park and Ride as follows:

(i) Initial design and construction shall accommodate 330 spaces; on completion of Station for Revenue Service.

(ii) The ultimate parking capacity shall be no less than 925 spaces.

(iii) The initial design including; grading, SWM features; sidewalks, accessible spaces, snow storage area, landscaping, drive aisles, lighting, CCTV and Emergency phones, etc. shall be constructed to be expandable to the ultimate capacity.

(iv) All electrical systems including the building service, and stand by power systems shall be sized for the ultimate buildout of the Park and Ride Facility.

(v) In the initial layout design, Project Co shall demonstrate in detail how the initial layout can be expanded to the ultimate parking capacity of 925 spaces with no upgrading and/or upsizing of the initial layout features and with no interruption of service on the initial layout.

(vi) Refer to civil requirement related to reuse of existing paving.

(e) No portion of the Station shall violate the Airport Zoning Regulations.

(f) Each Platform shall be served by a minimum of one elevator, one ramp and one public access stair for use during operational hours.

(g) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks

3.11 Bowesville Station

(a) Bowesville Station shall be a new Station located east of Bowesville Road and south of Earl Armstrong Road. The new Bowesville Station is a Line and Transfer Station with a Park and Ride Facility.

(b) The new Station shall have at a minimum one fare paid entrance with access to the Park and Ride Facility and PPUDO.

(c) The Station shall be designed to allow the Bus Platform to remain accessible to the public while securing the Train during Train non-Operating Hours.

(d) The Park and Ride facility shall be designed and constructed to accommodate initial capacity and design allowance for ultimate capacity configuration. Project Co shall design the initial and full buildout of the Park and Ride as follows:

(i) Initial design and construction shall accommodate 800 Spaces; on completion of Station for Revenue Service.

(ii) The ultimate parking capacity shall be maximized on the available property.

(iii) The initial design including; grading, SWM features; sidewalks, accessible spaces, snow storage area, landscaping, drive aisles, lighting, CCTV and Emergency telephones, etc. shall be constructed to be expandable to the ultimate capacity.

(iv) All electrical systems including the building service and stand by power systems shall be sized for the Ultimate buildout of the Park and Ride Facility.

(v) In the initial layout design, Project Co shall demonstrate in detail how the initial layout can be expanded to maximize the number of parking spaces with no upgrading and/or upsizing of the initial layout features and with no interruption of service on the initial layout.

(vi) The Park and Ride/bus surface facilities shall have a minimum of one shared entrance from Earl Armstrong Road. In the event Project Co's design involves rail over Earl Armstrong Road and/or Bowesville Road, Project Co shall provide multiple access points to the surface facilities.

(e) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

(f) Each Platform shall be served by a minimum of one elevator, one ramp and one public access stair for use during operational hours.

3.12 Uplands Station

(a) Uplands Station shall be a new Line Station located east of Uplands Drive adjacent to the EY Centre.

(i) The Station shall be designed to have either a center Platform or two side Platforms allowing the simultaneous loading/unloading of passengers on both Tracks.

(b) The Station shall have one fare paid entrance serving the EY Centre and future development north of the alignment.

(c) Project Co shall provide bus stop shelter, lighting, power, and TWSI connecting the bus stop with the Station fare gates at the entrance.

(d) The Station shall have a minimum 6m wide non fare paid connection to allow access from the north to the EY Centre.

(e) The Station Plaza and Site shall be designed to accommodate EY Center event patrons, which is not reflected in the Passenger Demand Forecast.

(i) The largest event will experience a tidal flow of 5,000 persons per hour out of the EY Centre. It is anticipated that 50% of the total flow will utilize the Station.

(ii) The Station Plaza shall be designed and constructed with an on street bus stop and bus shelter.

(f) Project Co shall realign the access road directly in front of the EY Centre, reconfigure the existing parking and bioswale to allow for a direct sightlines and access to the Station from the EY Center entrance.

(g) The Station shall be designed for both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

(h) Each Platform shall be served by a minimum of one ramp and one public access stair for use during operational hours.

(i) Project Co's design shall protect for the addition of one elevator to each Platform. Future elevator location shall be included on all submissions.

3.13 Airport Station

(a) Airport Station shall be a new elevated Terminal Station located adjacent to the airport departure roadway structure and the Airport Passenger Terminal Building;

(i) The Station Platform shall be located no further northeast from column line M of the existing Airport Passenger Terminal Building than that as required to accommodate the 22.5m from the buffer stop, unless otherwise agreed with the City and OMCIA during the design phase of the Project.

(b) The Station entrance and lounge will be an extension of the Airport Terminal Building and shall be constructed by the OMCIAA;

(c) The Station Platform shall be at the same elevation as the third level of the Airport Passenger Terminal Building;

(d) The City has entered into an agreement with the Airport Authority where by the Airport Authority will extend the existing Airport Passenger Terminal Building structure to the new Station. Project Co shall support the City in coordination of the design and construction of Airport Station including:

(i) Attend design and construction meetings with the Airport Authority;

(ii) Preparing drawings and presentation materials to be used in coordination meetings with the Airport Authority and the NCC;

(iii) Providing drawings in PDF and *.DWG formats to be used by the Airport Authority for design coordination;

(iv) Project Co shall be responsible for the design and construction of the Expanded Trillium Line System components as detailed in this Project Agreement;

(v) Project Co shall submit final issued for construction drawings, no later than October 4, 2019 to the City in PDF and DWG format, in accordance with Schedule 10 – Review Procedure;

A. Final issued for construction documents shall be reliant and binding; and,

(vi) Project Co shall complete all work on the Station in accordance with Schedule 15-2, Part 1, Clause 5.3, with the exception of works to be completed within the Airport Passenger Terminal expansion area including the installation of PIDs and CCTV cameras.

(e) Project Co shall design and construct the Station, Platform, Guideway and Guideway Structures to allow the Airport Authority to construct the Airport Passenger Terminal Building expansion including the Station entrance and lounge directly adjacent;

(i) Specific layout and detailing of the Station, Platform and Guideway Structure shall be coordinated with the OMCIAA and the design of the Airport Passenger Terminal Building expansion.

A. The Airport Passenger Terminal Building expansion and Expanded Trillium Line structures shall be independent Structures;

B. The design and construction of the Guideway and Platform support piers and piers caps/bents, shall allow the Airport Passenger Terminal Building expansion to be constructed directly adjacent to the Guideway including cantilevered structural supports;

C. The OMCIAA shall provide all expansion joint covers between the two Structures. Project Co shall coordinate requirements of the Expanded Trillium Line Structures to accept expansion joint covers with the OMCIAA; and,

D. In the event Project Co's design varies the location of the Platform with respect to the southern end in relationship to column line M of the existing Airport Passenger Terminal Building as indicated on Proposal Drawing 646120-BBA-S3AP-44DK-2001, Project Co shall:

i. Maintain the Platform area as indicated on Proposal Drawing 646120-BBA-S3AP-44DK-2001 for access into the Airport Passenger Terminal Building Expansion from the south and east;

ii. Provide additional Platform length in excess of that indicated on Proposal Drawing 646120-BBA-S3AP-44DK-2001 to allow the initial 40m minimum platform length for the boarding an alighting of Passengers;

iii. Project Co shall provide a Platform edge barrier system where Platform length is provided beyond the train stopping location on the Platform to prevent passenger from entering the guideway when a Train is at the stopping location on the Platform; and,

iv. Provide all amenities including weather protection (windscreen and roof), snow melting system, signage etc., for the entire Platform inclusive of the required 40m and any extension resulting from Clause 3.13 (e)(i)D.

(f) Project Co shall be responsible for the design and final installation of PIDS and CCTV cameras within the Airport Passenger Terminal Building expansion including cabling and devices.

(i) The OMCIAA is responsible to provide rough-in of PIDS and CCTV cameras in coordination with Project Co including conduits, raceways, and back boxes.

(ii) Project Co shall coordinate the location of the PIDs and CCTV cameras located in the Airport Passenger Terminal Building expansion with the City and the OMCIAA.

(g) Project Co shall design and construct the Station Platform to be harmonious with the design of the Airport Passenger Terminal Building.

(i) Windscreens and Platform canopy materials and details shall be consistent with the existing elements on the Airport Passenger Terminal departure level;

(ii) Project Co shall provide full height windscreen glazing for the Platform extending the entire length of the Station Platform;

(iii) Project Co shall provide Platform roof for the entire length of the Platform;

A. Platform canopy shall extend the greater of 2.5m from the Platform wind screen or 50% coverage of the Platform width.

(iv) Project Co shall provide an automated in-slab heat trace system as part of the Station Platform to maintain the Platform clear and free of ice and trace amounts of snow accumulation:

A. Platform heat trace system shall be automatically controlled by temperature and moisture sensors. The system shall be controlled by SCADA with ability to be monitored and controlled at the TOCC and by OMCIAA; and,

B. Building utilities, power, water, etc., required for the heat trace system shall be provided from the Airport Passenger Terminal Building.

(v) In addition to CCTV cameras required for coverage of the Station, Project Co shall provide rough in for CCTV system to be monitored by the OMCIAA.

A. Project Co shall be responsible to provide rough-in of CCTV cameras in coordination with the OMCIAA including conduits, raceways and back boxes.

B. Project Co shall coordinate the number and location of CCTV cameras with the City and the OMCIAA.

C. Project Co shall grant the OMCIAA access as required for installation commissioning and maintenance of CCTV cameras within the Station.

D. Project Co shall provide a fully enclosed TSA shelter on the Station Platform;

i. TSA shelter shall be custom designed and fully integrated with the OMCIA architectural language;

ii. TSA shelter shall be identical in size to the standard shelter utilized on the Trillium Line; and,

iii. TSA shall have the same amenities, in the same location as the standard TSA shelter utilized on the Trillium Line.

(h) Fire Life Safety

(i) Project Co shall work jointly with the OMCIAA to develop a comprehensive Fire Life Safety plan for the Station including NBCC code review for the integrated entrance;

(ii) Project Co shall be responsible for the Fire Life Safety requirements of the Station Platform area including exiting and coordination of the fire alarm systems of the Train Platform and the Airport Passenger Terminal Building;

(iii) Project Co shall be responsible for the fire department connection located at the discharge location of the Emergency egress stair and dry standpipe system for the Platform; and,

(iv) The OMCIAA shall be responsible for fire protection of the Airport Passenger Terminal Building expansion.

3.14 Limebank Station

(a) Limebank Station shall be a new Terminal Station located west of Limebank Road, south of Earl Armstrong Road and east of Main Street.

(b) The new Station shall have at a minimum one fare paid entrance with access to Main Street, the north east-west Connector Road, and the future south east-west Connector Road.

(c) The Station shall be designed as an urban Station with direct access to the on-street bus Facility located to the north of the alignment.

(d) Project Co shall provide two Emergency phones located at the bus stops on the east-west Connector Road, one per each direction of travel.

(e) Project Co shall provide a Station plaza with a minimum size of 400 m^2 that will serve the Station entry access fronting on Main Street and connection to the on-street bus Facilities to the north.

(f) The Station entry shall be setback a minimum of 8.0m from the eastern ROW of the future Main Street extension.

(g) The Station shall be designed to allow both Tracks to operate in Revenue Service allowing the simultaneous loading/unloading of Passengers on both Tracks.

ARTICLE 4 STRUCTURAL DESIGN CRITERIA

4.1 Introduction

(a) For the purpose of Structural design pertaining to this Article, a Station comprises the building(s), Site access, parking, Tracks, Platforms, Ancillary Facilities, and all appurtenances necessary to conduct Passenger transportation.

(b) Project Co shall design and construct Stations and Facilities in accordance with this Article. The structural design shall include design of new members, inspection and documentation of existing Structures impacted by the Station construction and corresponding rehabilitation design and construction.

(c) In addition to the submittals required elsewhere, the structural engineering services shall include the preparation of complete calculations (appropriately indexed), coordination with other disciplines and general review of construction. Structural calculations shall be provided to the City in each required submission.

(d) In addition to the requirements set forth in Article 4 of this Part 4, requirements for Pedestrian Bridges not forming part of the Station Structure are included in Schedule 15-2, Part 2, Article 4 - Structural Design Criteria and Requirements.

4.2 Reference Documents

(a) The structural design shall comply with the criteria contained in this Article, and all standards, regulations, policies, Applicable Law, guidelines or practices applicable to the Project, including but not limited to each of the following Reference Documents. In the event of a conflict between criteria, commitments or requirements contained within one document when compared with another, the more stringent shall apply:

(i) OBC;

(ii) NBCC; where applicable

(iii) User's Guide – NBCC: Structural Commentaries (Part 4); where applicable

(iv) CAN/CSA S6 - CHBDC*;

(v) CAN/CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete;

(vi) CAN/CSA A23.3 - Design of Concrete Structures;

(vii) CAN/CSA O86 - Engineering Design in Wood;

(viii) CAN/CSA S16 - Design of Steel Structures;

(ix) CAN/CSA S304.1 - Design of Masonry Structures;

(x) CAN/CSA S136 – North American Specification for the Design of Cold-Formed Steel Structural Members;

(xi) *Note: Portions of the Station that support Vehicle loads shall be considered Train Structures. Train Structures shall be designed to satisfy the requirements of this Article and Schedule 15-2, Part 2, Article 4 - Structural Design Criteria and Requirements and shall meet or exceed the applicable building code(s) and the CHBDC.

(xii) Canadian Foundation Engineering Manual;

(xiii) CAN/CSA S478 – Guideline on Durability in Buildings;

(xiv) ACI 201.2R – Guide to Durable Concrete;

(xv) AREMA Manual for Railway Engineering hereinafter referred to as the AREMA Manual

(xvi) ACI 360R – Design of Slabs on Grade;

(xvii) CSA S448.1 – Repair of Reinforced Concrete in Buildings and Parking Structures;

(xviii) AISC/CISC Steel Design Guide Series 11 – Floor Vibrations Due to Human Activity;

(xix) OHSA;

(xx) PEO Professional Engineers Providing Services for Demolition of Buildings and Other Structures;

(xxi) MTO Structure Rehabilitation Manual;

(xxii) MTO Ontario Structure Inspection Manual;

(xxiii) MTO Structural Manual;

(xxiv) MTO Structural Steel Coating Manual;

(xxv) OPSS and OPSD;

(xxvi) ASTM E2018 Standard Guide for Property Condition Assessments: Baseline Property Condition Assessment Process;

(xxvii) ASCE Structural Condition Assessment of Existing Structures;

(xxviii) AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges;

(xxix) City of Ottawa Transitway and Station Design Guidelines; and,

(xxx) ISO 12944-5 Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems.

4.3 General Requirements for Station Structures in Expanded Trillium Line

(a) Ground Level Platform Framing

(i) Where the new Platform is in proximity to cause an impact on an existing adjacent structure, Project Co shall design and construct the new Platform without reducing the

performance level of the existing adjacent structures. Evaluate the effects on the existing structures of excavation, vibration and long-term settlement during design stage.

(ii) Project Co shall design and construct the Station structural system to allow for the expansion of the Station Platform in the future without any reinforcing or alterations.

(iii) Project Co shall utilize hot-dip galvanized or stainless steel concrete reinforcement within 120mm from the top surface of the Platform slab.

4.4 Station Specific Structural Design Requirements

(a) Project Co shall provide Station Specific Structural Design Requirements

(i) Gladstone Station

A. Project Co shall design and construct roof and canopy structures covering the Platform to accommodate snow drifting from all higher adjacent horizontal surfaces including adjacent higher building structures and ground level surfaces.

B. Project Co shall provide a barrier/vehicle guard rail at adjacent high ground level surfaces accessible to maintenance vehicle and when the drop of elevation is more than 500 mm. The barrier/vehicle guard rail shall be capable of resisting vehicle impact load as per OBC.

C. Refer to Schedule 15-2, Part 2 – Article 7 – Geotechnical Design Criteria and Requirements for requirements on rock face protection.

(ii) Walkley Station

A. Project Co shall account for the impact of the new construction, on adjacent existing retaining wall of the Walkley Bridge abutment, including the foundation. Project Co shall mitigate in the design and construction, any increased loading on the existing Structure in accordance with the applicable codes and standards.

B. Project Co shall design and construct new guardrail at the Station entrance to resist vehicle impact load in accordance with OPSD.

(iii) South Keys Station

A. Project Co shall limit the additional settlement of existing structures resulting from the new embankment to a maximum of 10mm. Limit the additional stresses in the existing structures resulting from the new embankment, such that there are no cracks wider than 0.2mm.

B. The existing railway Structure shall be part of the Station Structure. Project Co shall comply with the requirements in Article 4.11. Project Co shall evaluate and rehabilitate the Structure in compliance with the requirements of OBC, AREMA, SRM and CHBDC.

4.5 Stations Constructed on Federal Lands

(a) Stations located on Federal Lands are subject to the regulations of the NCC. Project Co shall design Stations on Federal Lands in accordance with requirements of both the OBC and the NBCC. Stations outside of Federal Government lands shall comply with the requirements of the OBC.

4.6 Durability

(a) Project Co shall provide materials, details and protection systems to meet or exceed the specified requirements for durability in OBC and CHBDC.

(b) Project Co shall provide time-dependent design calculations, including corrosion, fatigue and creep shall be based on the required Design Life as outlined in Schedule 15-2, Part 1, Article 4 – Design and Construction.

(c) Project Co shall provide testing report for chloride penetrability for concrete of exposure class C-1 and C-XL in accordance with Schedule 10 – Review Procedure.

(d) Project Co shall provide stainless steel reinforcing steel in substructure concrete within the splash zone of adjacent Roadways. Splash zone shall be as defined in MTO Structural Manual.

(e) Project Co shall utilize hot dip galvanized steel for exposed structural steel and reinforcing steel in concrete when within 1m of all walking and vehicular surfaces, stairs, ramps, that are subject to foot and vehicular traffic.

(f) Project Co shall install hot dip galvanized steel reinforcing in concrete where de-icing salt could be applied directly on the surface, or brought about by foot traffic.

(g) Project Co shall design and construct all structure members not within the heated space to be capable of withstanding freeze-thaw effects without negatively impact the design objectives.

(h) Project Co shall design and construct members detailed to minimize exposed surface area and avoid pockets, crevices, recesses, re-entrant corners, and locations that collect and retain water, debris, and moisture.

(i) Project Co shall design and construct Structures to provide access for Maintenance and inspection with conventional techniques included in MTO's Ontario Structure Inspection Manual, Structure Rehabilitation Manual and Structural Manual for all components of the Structure. Inspection and Maintenance access and maintainability shall meet the requirements in clause 1.8.3 in CSA S6-14.

(j) Project Co shall design all structural components exposed to weather conditions predicated on routine inspection and Maintenance procedures being instituted.

4.7 Station Structural Loads

(a) Project Co shall provide design Structures utilizing dead loads in accordance with the following:

(i) Project Co shall use standard mass densities for materials, unless analysis or testing indicates that other criteria shall be used. Perform a sensitivity analysis for the actual

weight where a variation might affect the adequacy of the design or in cases where the construction may vary from normal practice.

(b) Project Co shall provide design Structures utilizing live loads in accordance with the following:

(i) Live loads include the Vehicle design loads and highway vehicular loads specified in Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements as well as all floor and roof live loads as described in the design codes and standards specified earlier in this Article.

(ii) Vehicle Live Load:

A. Refer to Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements for Train loads.

B. Design Platforms and ramp slabs wider than 3m and accessible to Maintenance Vehicles for a concentrated vehicle load as per OBC, or the maintenance vehicle load as defined in CHBDC, whichever produces the more critical structural responses.

C. Design sidewalks, Plazas and other open areas wider than 3 m, adjacent to road way and without permeant barrier to separate the roadway from the area, the supporting structure for CL-625 ON truck load as defined in CHBDC, or fire truck load as per OBC, whichever produces the more critical structural responses. Design Structural members within that area for collision force defined below.

(iii) Design electrical equipment rooms, pump rooms, machinery rooms, storage rooms, service rooms, battery rooms and fan equipment rooms containing fire ventilation equipment for a specified live load of 12kPa, or the actual equipment load where greater than 12kPa, applied uniformly over the entire area, or on any portion of the area, whichever produces the most critical effects in each member.

(iv) The minimum specified live load on the Platform extenders shall be 12kPa, and maximum deflection in level Platform position shall be 2mm.

(c) Project Co shall design Structures utilizing environmental loads in accordance with the following:

(i) Snow, rain, ice, ice accretion, wind and earthquake loads shall be as described in the design codes outlined earlier in this Article using the OBC Importance Category of "Normal".

(ii) Include allowance for the build-up of ice on Track slabs and the build-up of compacted snow on vertical faces of barrier walls and Platform support walls adjacent to Track slabs at exposed parts of above grade Stations where the potential for such build-up exists. The magnitude of these loads shall suit the planned snow removal system.

(iii) Design Station Structures, partitions and affected non-structural elements to resist the piston effect wind pressures from transit Vehicles. The minimum uniform design pressure for these elements shall be 2.0 kPa in either the positive or negative direction.

(d) Project Co shall design Structures utilizing Fatigue Loading in accordance with the following:

(i) Assess ridership criteria determine the expected number of Trains the Structure will support during its Design Life. Apply a service load analysis for fatigue to affected structural elements and is generally based on the number of full loading cycles that are applied to the Structure. The loading cycles applied to each member and connection shall include the number of Vehicles, trucks or wheel load passes, whichever produces the most critical effect.

(e) Project Co shall design Structures utilizing Earth Loading in accordance with the following:

(i) Vertical and horizontal earth pressures acting on retaining walls and Underground Station Structures: refer to Schedule 15-2, Part 2, Article 7 – Geotechnical Design Criteria and Requirements and Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements.

(ii) Design Structures which retain earth for horizontal earth pressure due to earth against the Structure and load surcharges resting on the soil above or beside the Structure.

(iii) Vertical pressure from superimposed earth load shall be based on a mass density of 22 kN/m^3, for compacted, granular materials. Consider a minimum earth load assuming that one metre of fill may be removed for road or Utility construction shall.

(f) Project Co shall design Structures utilizing water/buoyancy/flood loading in accordance with the following:

(i) Consider the effects of water pressure and buoyancy whenever groundwater is present. Establish high and low water tables for the life of the Structure with due consideration given to the possibility of future changes in groundwater elevation.

(ii) The design shall take into account the effect of water pressures during the construction sequence.

(iii) During construction and backfill operations, observe and control the elevation of the groundwater so that the calculated total mass of Structure and backfill shall always exceed the calculated uplift due to buoyancy by a safe margin. The backfill shall be considered as the volume contained within vertical planes defined by the outside limits of the Structure.

(iv) Local flooding may also add load to underground Structures. Design of the Structure shall make allowance for flood elevations based on 100 year flood data.

(g) Project Co shall design Structures utilizing adjacent Structure/additional surcharge loading in accordance with the following:

(i) Horizontal and vertical distribution of loads from foundations of existing buildings shall be determined by Project Co.

(ii) Determine the minimum and maximum loads which can be transferred to the underground Structure. Where possible, these loads shall be based on the actual design loads for the Adjacent Structure. In the absence of this information, Use the methods in the Reference Documents in clause 4.2 of this Part 4 to evaluate probable loading of the existing Structure. The loading shall have at least the minimum level of performance on

the objectives and functional statements stated or implied in Reference Documents in clause 4.2 of this Part 4.

(iii) When performing the above analyses, determine the need for all permanent underpinning of buildings or Structures.

(h) Project Co's design and construction of Structures shall allow for Thermal, Shrinkage, and Creep Loading in accordance with the following:

(i) Project Co shall consider the secondary effects due to the stresses and movements resulting from temperature changes, thermal gradients, creep and shrinkage in the design and construction of all Structures. Project Co shall determine these loads and the appropriate design solution in accordance with the requirements of OBC, NBCC, CAN/CSA S6 and AREMA, as applicable.

(i) Project Co's structural design and construction shall allow for Other Loads and Effects in accordance with the following:

(i) as applicable to the use and occupancy for the Structure or element under consideration;

(ii) as required by the design codes, standards and references listed in this Article;

(iii) Refer to Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements for Vehicles and Vehicle loads;

(iv) Construction loads, construction staging loads and Maintenance loads;

(v) Loads due to fan induced airflows during operation of fire ventilation fans;

(vi) Loads induced on the Structures by tolerable differential settlement;

(vii) Loads to protect for future expansion where applicable; and

(viii) Other loads and effects specified in Schedule 15-2, Part 2, Article 9 - – Protection of Existing Adjacent Structures and Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements where applicable.

4.8 Load Combinations

(a) Project Co shall design and construct Structures utilizing Load Combinations in accordance with the following:

(i) Load factors, resistance factors and load combinations shall be in accordance with the applicable building and Bridge codes for the particular Station and structural element under consideration.

(ii) Refer to Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements for load factors, resistance factors and load combinations for Station Structures supporting Vehicles.

(iii) Where the Station structure is subject to Vehicle load, Project Co shall design the structure based on OBC and CHBDC.

(iv) For Structures carrying more than one Track, Project Co shall determine the combination of Vehicle axle loads on one or more Tracks which produces the most critical effect.

4.9 Design Considerations of Retaining Walls:

(a) Project Co shall ensure that the design considerations and factors influencing the behaviour of retaining walls shall be as per CAN/CSA S6 and OBC. The design of any retaining wall is Site specific, necessitating the need for specific geotechnical input and an understanding of wall construction methods. Provide architectural enhancement of walls where specified in the architectural design.

(b) Project Co shall design and construct retaining walls to resist the following loads:

(i) Superimposed surface and subsurface loads (Adjacent vehicles and Structures);

(ii) System imposed forces (trackway vicinity);

(iii) Earth or rock pressures and hydrostatic pressures;

(iv) Earthquake lateral pressures;

(v) Wind Loads, where required;

(vi) Self-weight;

(vii) Loads during construction;

(viii) Thermal, shrinkage, and creep loads; and

(ix) Other retaining wall loads specified in Schedule 15-2, Part 2, Article 7 – Geotechnical Design Criteria and Requirements and Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements.

(c) Project Co shall analyze retaining walls for:

(i) Stability against sliding;

(ii) Stability against bearing failure and overturning;

(iii) Settlement;

(iv) Overall stability;

(v) Structural strength;

(vi) Protect for future wall repair when locating retaining walls;

(vii) Provide Compensating Construction where existing retaining walls are impacted by the Station renovations as required by OBC and NBCC, as applicable; and

(viii) Other requirements specified in Schedule 15-2, Part 2, Article 7 – Geotechnical Design Criteria and Requirements and Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements.

4.10 Other Design Considerations:

(a) Project Co shall ensure that the design of the structural foundations, superstructures, systems, elements and connections meet all of the requirements stipulated in the codes, standards and references listed in this Article.

(b) Project Co shall slope structural members to provide drainage where required.

(c) Project Co shall include the deflection and vibration control measures in their design:

(i) All structural members shall have adequate stiffness to limit deflections which may adversely affect the strength and serviceability of the Station Structure.

(ii) In members supporting Train loads, deflections due to live load, including dynamic factors, shall not exceed 1/1000 of the span for interior spans and 1/300 for cantilever arm length.

(iii) Limit the maximum total (dead and live load) long term total deflection considering creep and cracking for members supporting Train loads to 1/500 of the interior spans and 1/180 of cantilever arm length.

(iv) Design members not supporting rail loads, such as roofs, concourse and Platform slabs to standard acceptable engineering practices for serviceability taking into consideration the flexibility, or lack of flexibility, of the materials supported by the Structure.

(v) Proportion members and systems supporting the light rail System so that the natural frequency of the first mode of vertical vibration is greater than 2.5 Hz.

(vi) Design floor systems susceptible to vibration in accordance with AISC/CISC Steel Design Guide Series 11 – Floor Vibrations Due to Human Activity, to meet the acceptance criteria for indoor footbridges.

(d) Project Co shall design and construct foundations as follows:

(i) Settlements

A. Design foundations so that total and differential settlements do not adversely affect the strength or serviceability of the Station Structures.

B. Design Structural members and systems supporting Vehicles so that total and differential settlements do not adversely affect the operation and serviceability of the Vehicles.

(ii) Pile design and detailing shall meet requirements in OBC, MTO Structural Manual, CHBDC. If requirements are not specific in those documents, Project Co shall follow the requirements in AASHTO LRFD Section 10.

(iii) Provide measures to prevent frost heave. The acceptable measures shall be taken from Reference Documents in Section 4.2.

(e) Project Co shall include the following seismic design for elements of Structures, non-structural components and equipment.

(i) Seismic Importance Category for Station Structures shall be "Normal".

(ii) Design elements and components of buildings, non-structural components and equipment for earthquake loads and effects as required by OBC and NBCC.

(iii) The load factor for earthquake effect on Vehicle shall be in accordance with Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements.

(f) Project Co shall design and construct waterproofing in accordance with the following:

(i) The following application shall be sealed to prevent water ingress:

A. Underground pits, shafts and rooms.

B. Platforms, walkways, Track structure and roadways over rooms or spaces

C. Walls and floors off buildings subject to hydrostatic pressure.

(ii) The design measures shall provide zero leakage for the Design Life of the Structure.

(iii) The material and construction of waterproofing shall follow requirements in ASTM, OPSS and CAN/CGSB.

(g) Project Co shall design and construct fire protection in accordance with the following:

(i) Structural elements and load bearing assemblies shall be of the required type of construction and shall have fire resistance ratings as required by the code analysis and the architectural design.

(ii) Provide concrete cover to reinforcing steel in reinforced concrete elements as required, to provide the required fire resistance rating for the element or assembly.

(iii) Provide intumescent paint where the architectural design utilizes exposed structural steel assemblies that require a fire resistance rating.

(iv) Adhesive anchors shall not be used for connections for structural assemblies required to have a fire resistance rating.

(h) Project Co shall protect for the future replacement of elevators, transformers, ventilation fans and other large/heavy equipment without strengthening and/or temporary removal and replacement of structural members.

(i) Project Co shall locate columns away from public circulation areas. When columns are unavoidable, minimize the column cladding and size so as to maximize sightlines and customer circulation.

4.11 Existing Structures:

(a) Project Co shall include the following with respect to the conditions of existing Structures affected by new construction:

(i) An existing structure is considered modified under one or more of the following situations:

A. Geometries are modified,

B. Material properties are modified,

C. Support condition are modified,

D. loads are changed,

E. Environmental condition is changed,

F. A new member is attached to an existing structural member resulting in load sharing between the new and existing members, or

G. Project Co's Geotechnical Engineer shall define the zone of influence in accordance with *User's Guide - NBCC 2015, Structural Commentaries (Part 4 of Division B)*, *Commentary on CSA S6 (C6)*, and *CFEM*.

(ii) Project Co shall demonstrate that the performance of the modified existing Structure meets all the applicable standards and requirements in this Article, regardless of the deficiencies in the existing Structures at the time of Contract Award, where deficiencies could be resulted from construction, material, design, normal course of deterioration, or damage prior to the Commercial Close.

(iii) The structural soundness of the existing member affected by the construction shall be investigated to ensure it is capable of supporting the new member within the Design Life of the new member.

(iv) Project Co shall inspect and document the conditions of the existing structures affected by the construction. The content and the documentation of the inspection shall follow the requirements in MTO Structure Inspection Manual, MTO Structure Rehabilitation Manual, ASTM E2018 or ASCE Structural Condition Assessment of Existing Structures. The requirements in the above references apply only when appropriate. Necessary additional or alternative criteria are subject to Approval.

(v) Refer to Schedule 15-2, Part 2, Clause 4.4(q)(ii) for requirements for Structures within ZOI.

(b) Project Co shall design and construct the renovation of Existing Structures in accordance with the following:

(i) Comply with OBC and NBCCC as applicable. If the structural member is exposed, comply with MTO Structure Rehabilitation Manual.

(ii) Comply with the Heritage Act as applicable.

(iii) Obtain background drawings, specifications and construction records for the affected Structures.

(iv) Perform as built surveys to verify the accuracy of the background drawings.

(v) Excavate test pits to verify the size and depth of existing foundations.

(vi) Conduct destructive investigations to verify existing conditions.

(vii) Conduct materials testing to determine and verify existing material properties.

(viii) Comply with the requirements for Basic Renovation or Extensive Renovation as determined by the code analysis at each location.

(ix) Provide Compensating Construction as required by OBC and NBCC, as applicable.

(x) Perform selective demolition in accordance with OBC and NBCC as applicable,

(xi) Repair any damage caused by the Work to the satisfaction of the property owner.

(c) Project Co shall include the following with respect to the interface between existing and new deck Structures supporting pedestrian and vehicular traffic:

(i) At locations where new framed floors are built adjacent to existing floor/Bridge Structures, design and construct new Structure in a manner that minimizes the vertical differential movement at the interface between Structures so that normal serviceability of the Station is maintained under permanent and transient loads. Joints between new and existing slabs shall be flush with no vertical offsets that could create pedestrian tripping hazards or bumps under wheel loading. The design shall address: long term deflection (creep) of concrete; differential live loading; total and differential footing settlement; beam and slab camber; expansion joint cover design; and other effects where applicable.

(d) Where existing Structures are incorporated into or form part of the Station Structures, rehabilitate the existing Structures as required to meet the required Design Life as per Schedule 15-2, Part 1, Article 4 – Design and Construction.

(i) Estimate the remaining life of the existing structure using a method and parameters recommended in peer-reviewed publications. Submit documents supporting the estimated remaining life to the City for review and approval.

(ii) The inspection, evaluation and rehabilitation of the existing structure shall follow the requirements in the Reference Documents in clause 4.2 of this Part 4.

4.12 Reinforced Concrete

(a) Project Co shall design and construct reinforced concrete in accordance with the following:

(i) This Subsection applies to reinforced, prestressed, and precast concrete Structures.

(ii) Provide a nonslip surface finish in accordance with CAN/CSA A23.1 at exterior slabs subject to pedestrian traffic and at other locations required by the architectural articles.

(iii) Provide hardener at exposed concrete floors.

(iv) Joints in Structures

A. Provide expansion joints, contraction joints and construction joints: in accordance with the all applicable codes and standards and in accordance with good industry practice; to control shrinkage stresses and minimize shrinkage cracking; and to meet or exceed the requirements for durability specified in clause 4.6 of this Article.

B. Provide waterstops in all joints below grade.

C. Construction joint locations shall be planned in advance in order to minimize the number of joints while still keeping the length of individual concrete pours within standard acceptable maximum lengths. The shape of the pour as well as the amount of reinforcement in the section shall be taken into consideration when determining joint location and spacing.

(v) Field sampling and testing of concrete and acceptance criteria for quality assurance shall follow the requirements in OPSS 1350.

4.13 Structural Steel

(a) Project Co shall design and construct Structural Steel in accordance with the following:

(i) The Code of Standard Practice for Structural Steel published by the CISC shall be referenced with respect to the furnishing of structural steel.

(ii) Design of structural steel Structures shall be in accordance with CAN/CSA S16 Design of Steel Structures and CAN/CSA S6 Canadian Highway Bridge Design Code, where they are applicable.

(iii) Design of cold formed steel Structures shall be in accordance with CAN/CSA-S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

(iv) All structural steel left exposed and viewable by the public shall be AESS:

A. Project Co shall provide AESS in accordance with CISC Code of Standard Practice for Structural Steel, Appendix I as follows:

i. Category 3 AESS: AESS that is within 6m vertically or horizontally of a walking surface and is visible to a person standing on that walking surface.

ii. Category 2 AESS: AESS that is not defined as Category 3 or that can be viewed at a distance greater than that specified in Category 3.

(v) Provide concealed connections where required by the architectural design.

(vi) Protection of Steelwork

A. Project Co shall endeavour to make all parts of a Structure accessible for inspection, cleaning and Maintenance. Where this is not possible, consideration shall be given to concrete encasement of steelwork, use of special protective coatings or the use of atmospheric corrosion resistant steel.

(vii) Protective Coatings

A. Protect Structural steel members and connections exposed to weather, high humidity or water spray against corrosion in accordance with MTO Coating Structural Manual. Minimize localized corrosion likely to occur from entrapped water, excessive condensation, or from other factors by suitable design and detail. Provide positive means of drainage to prevent standing water on steel surfaces.

B. Painting of interior structural steel shall meet the requirements of ISO 12944-5 for the applicable corrosive environment and desired Design Life of the coating system.

C. Co-ordinate the protective coating systems with the architectural design.

D. The minimum protection system shall be painting with a high performance coating system.

E. Where hot dip galvanized protection system is utilized, the following shall apply:

i. Protection shall be restored when damage to the galvanized coating has occurred during welding or as a result of rough handling or abrasion.

ii. Where exposed to public view, all galvanized surfaces shall be finish painted.

(viii) Project Co shall not use steel deck for Structures exposed to the exterior or to deicing salts.

4.14 Masonry

(a) Project Co shall design and construct masonry in accordance with the following:

(i) Design of masonry Structures shall be in accordance with CAN/CSA S304.1

(ii) Horizontal joint reinforcing shall be galvanized.

(iii) Design masonry Structures to resist all applied vertical and lateral loads as required by the OBC (and the NBCC where applicable). This requirement applies to load-bearing and non-load-bearing masonry.

4.15 Concrete Slabs on Grade

(a) Project Co shall design and construct concrete slabs on grade in accordance with the following:

(i) Design Track slabs in accordance with AREMA, CAN/CSA S6 and ACI 201.2R.

A. Refer to Schedule 15-2, Part 2 – Civil and Guideway, for Track slab Design requirements.

B. Transition areas require special considerations. Design of transition areas shall account for the susceptibility of backfill soil material to settlement behind bridge abutments. An approach slab shall be used in these areas.

(ii) Design Platform and other slabs on grade in accordance with CAN/CSA A23.3 and ACI 360R.

(iii) Remove existing fill material below slabs on grade and replace with engineered fill to a depth and extent as required to meet the limitations for settlement specified in clause 3.8 (d) of this Article. Reuse of existing excavated fill material is subject to Geotechnical Engineer's confirmation that the existing fill is suitable for re-use.

(iv) Design and construct the interface between Track slabs and Platform slabs to maintain the vertical distance between top of rail elevation and finished Platform elevation as required by the Vehicle with short and long-term differential settlements not to exceed the tolerance specified by the Vehicle manufacturer for vertical offset between the Track and finished Platform elevations. Refer to Schedule 15-2, Part 8 - Vehicles for Vehicle and Platform construction tolerance.

(v) Provide control joints or other measures to prevent uncontrolled shrinkage cracking.

(vi) Where the location and spacing of transverse joints in Track slabs does not match the location and spacing of joints in the adjacent Platform slabs, provide connection design and detailing at the interface between slabs to address differential concrete shrinkage.

(vii) Design joints to prevent vertical differential movement between slab panels.

(viii) Provide slopes to drain slabs and prevent ponding.

(ix) Provide subdrainage systems below slabs at locations where the potential exists for the groundwater elevation to reach the underside of the slab subbase.

ARTICLE 5 MECHANICAL DESIGN CRITERIA

5.1 Introduction

(a) Project Co shall design and construct mechanical systems for the Stations and Ancillary Facilities of the Project in accordance with this Article.

(b) The requirements within this Article shall govern the functional, operational and control requirements of the HVAC, Plumbing & Drainage Systems, Fire Protection Systems, and BAS for the Project.

5.2 Reference Documents

(a) Project Co shall design and construct all applicable codes, standards, regulations, policies, applicable laws, guidelines or practices applicable to the Project requirements, including but not limited to the latest version of each of the following documents. In the event of a conflict between criteria, commitments or requirements contained within the document and this Article when compared with another, the most stringent shall apply.

(i) OBC;

(ii) NBCC;

(iii) OFC;

(iv) OESC;

(v) CEC;

(vi) CSA;

(vii) OHSA;

(viii) AHRI;

(ix) AMCA Standards;

(x) ANSI Standards;

(xi) ASHRAE Standards and Handbooks;

(xii) MNECB;

(xiii) Green Energy Act;

(xiv) ASPE;

(xv) ASME;

(xvi) ASTM;

(xvii) NEMA;

(xviii) SMACNA;

(xix) TIAC;

(xx) PDI;

(xxi) UL;

(xxii) ULC;

(xxiii) NFPA Standards;

(xxiv) Governmental Authorities

5.3 General Requirements

(a) Project Co shall design and construct all mechanical systems including equipment, ductwork, pipes, supports, accessories, and their connections to the Structure to resist seismic force and to accommodate building seismic deflection in accordance with the OBC. Additionally, where mechanical infrastructure crosses expansion joints, or other places where differential lateral displacement may occur, the piping, ducts etc. shall be attached in a manner that accommodates the differential movement.

(b) All floor-mounted equipment shall be installed on concrete housekeeping pads designed and constructed to facilitate the weight and inertia of the equipment.

(c) Roof-mounted equipment shall be installed on supports/roof curbs provided by the equipment manufacturer.

(d) Project Co shall coordinate associated architectural and structural requirements for mechanical systems.

(e) Provide adequate service spaces around all equipment. As a minimum, such spaces shall not be less than that indicated in the equipment specification and installation instructions.

(f) Mechanical equipment and systems shall be designed so that the maximum noise transmitted by the systems does not exceed OHSA and ASHRAE Standards.

(g) Where new mechanical systems are connected to existing mechanical systems, the existing mechanical systems shall be modified to suit the requirements of new systems. The modifications shall be in compliance with OBC, codes, standards, and meet requirements set forth in this Article.

(h) Project Co shall provide technical calculations for review during each phase, in accordance with Schedule 10 – Review Procedure.

(i) TAB and commissioning shall be performed for all mechanical systems.

(j) Requirements set forth in this Article for Stations shall also apply to service facilities located in Tunnels.

(k) Electric motors shall be NEMA premium efficiency. Fractional horsepower motors shall be electronically commutated motors.

(l) All mechanical systems and equipment shall be designed and installed to eliminate the transmission of vibration and noise to other part of the building and to applicable standards, regulations and codes. Provide vibration isolators for mechanical equipment and components.

5.4 Station specific Requirements

(a) Bayview Station

(i) Project Co shall design and construct a new partially enclosed glazed connection corridor that shall be naturally ventilated per ASHRAE 62.1. Where natural ventilation is inadequate, mechanical ventilation shall be provided. Adequacy of natural ventilation shall be confirmed by calculation or a computer program.

(b) Carling Station

(i) Project Co shall modernized the existing elevator as per requirements of all elevator related articles, the existing mechanical systems serving the elevator equipment and elevator shaft shall be modified or new systems be provided to satisfy the requirements set forth in this Article.

(c) Leitrim Station

(i) Project Co shall design and construct a private sanitary sewage system at Leitrim Station.

A. Private sanitary sewage system capacity shall be sized by Project Co to accommodate the Station's bus Operator's building, as determined by occupancy and use calculation in accordance with OBC plus an additional 20%.

B. Drinking water to the new Station shall be serviced from the existing Municipal drinking water infrastructure. The use of wells to provide drinking water services to the Station shall not be permitted.

(d) Bowesville Station

(i) Drinking water to the new Station shall be serviced from the existing Municipal drinking water infrastructure. The use of wells to provide drinking water services to the Station shall not be permitted.

(e) South Keys Station

(i) Project Co shall ensure the new pedestrian underpass and the new Station expansion are naturally ventilated and ventilation is adequate. The environment of the public areas of the existing Station shall not be affected by the new Station. Where natural ventilation is inadequate, mechanical ventilation shall be provided. Adequacy of natural ventilation shall be confirmed by calculation or a computer program.

5.5 HVAC

(a) Project Co shall provide HVAC in accordance with the following:

(i) HVAC design parameters for Stations and Ancillary Facilities shall be as follows:

A. System concepts shall be based on the energy conservation guideline of the MNECB, OBC, and ASHRAE 90.1.

B. Rooms that service equipment that require reliability, such as communication rooms, telephone rooms, signal rooms, elevator machine rooms shall be adequately positively pressurized to mitigate infiltration of brake dust from Train movements.

C. Rooms containing equipment that requires condition control shall be designed to suit the equipment as per the manufacturer's recommendations or the occupancy requirements, whichever are the most stringent.

D. Rooms that are occupied shall be provided with outside air requirements per person as defined in ASHRAE, and, if found to be applicable, air-conditioning, based on the number of occupants, and heated, all to suit staff comfort conditions.

E. Rooms that are unoccupied and do not require condition control for equipment shall have a minimum air change rate as determined to suit the room functions.

F. Rooms that contain equipment and systems that may give off airborne particles, odours, or chemicals shall be exhausted to outside at grade level.

G. Washrooms and janitor rooms shall be exhausted to outside at grade level.

H. Battery rooms shall be exhausted to outside at grade level via duty and standby exhaust fans.

I. Air-conditioning systems serving elevator machine rooms shall be designed such that elevator equipment shall be operational during Station fire Emergency.

J. HVAC systems serving critical rooms such as communication rooms, signal rooms, control rooms, telephone rooms shall be designed such that those equipment shall be operational during Station fire Emergency.

K. Elevator shafts shall be provided with HVAC to meet requirements CSA B44 and elevator manufacturer.

L. Maximum room design temperatures shall be selected to suit the room function and occupancy.

M. Spaces requiring heating only shall have ventilation systems (as a separate system or a combined heating and ventilating system if deemed size appropriate) that provides cooling by introducing ambient (outside) air at a rate to limit the

maximum space temperature to 5.5°C above ambient (outside) temperature unless otherwise required in this Article.

N. Where feasible, systems shall be designed to be capable of providing free cooling by introducing 100% ambient (outside) air. Where the use of outside air results in unacceptable air change and flow rates, provide mechanical air conditioning.

O. Outside air intakes shall be located at grade level to avoid the introduction of dirt, debris, fumes, odours, noise, irritants and biological agents from traffic and other external sources.

P. All occupied or unoccupied spaces, rooms that contain critical equipment shall have individual temperature control.

Q. All equipment, dampers, fittings installed in ductwork shall have flange duct connections.

R. The analytical design of the ventilation systems serving the public area of the Stations shall be carried out by the use of a certified applicable computer modeling program.

(ii) HVAC design Conditions

A. The HVAC outdoor design conditions for both underground and above ground Stations shall be as per OBC.

B. The HVAC indoor design conditions for Station spaces shall be as detailed in Table 4-5.1 below

C. Project Co shall determine the indoor environmental requirements for all support spaces not included in Table 4-5.1 in accordance with Applicable Law, and within the manufacturer's operating range of equipment housed within the space.

Table 4-5.1 - HVAC Indoor Design Conditions

Space/Room	**Minimum Temperature (ºC)**	**Maximum Temperature (ºC)**	**Outside Air per Occupant(l/s)**	**Air Filtration (MERV)**	**Humidity Summer / Winter (%RH)**
Fare Equipment Room	22	26	12	12	50/30
Lunch Room	22	24	17	8	50/10
Bus supervisor's office	22	24	17	8	50/10
Multi-purpose Room	22	24	17	8	50/10
Public Washrooms	18	5.5 (See Note ii)	(See Note iii)	8	-

Notes:

i. Ventilation design shall maintain space temperature design for 5.5° above outside ambient summer design temperature. Space may be included in central air handling system that provides heating and cooling if justified by first cost as add-on to space(s) that require mechanical cooling.

ii. Provide mechanical exhaust system at exhaust rate as required by the OBC. Provide outside air for exhaust air make-up. Recirculation of supply air to this space is not permitted.

(b) HVAC equipment and systems

(i) Select equipment to provide the highest operating efficiencies available.

(ii) Mechanical equipment shall be commercial or industrial grade.

(iii) To the extent practical, condensing units shall be located at grade or heat from condensing units shall be rejected to outside at grade.

(iv) Condensing units shall not be located in Tunnels, shafts, or any other areas subject to brake dust and debris.

(v) Condensing air for ducted condensing units shall be taken from a location at grade, free from brake dust and debris.

(vi) Heat recovery systems as well as free cooling shall be utilized to facilitate energy conservation as per ASHRAE 90.1, OBC and local standards.

(vii) The level of fresh air supplied to occupied space shall be automatically controlled for energy conservation.

(viii) Gas-fired unit heaters shall be high efficiency with stainless steel burner.

(ix) Heating systems shall be integral with cooling systems. Heated spaces shall be heated with electric heaters where heating and cooling air-handling units are not provided for the space.

(x) For above grade buildings only, indirect high efficiency gas-fired heating equipment may be considered.

(xi) Provide electrical radiant heaters for all Train and bus Platform TSA shelters.

A. Heaters shall be monitored and controlled by the BAS.

B. Each unit(s) severing a shelter shall be independently controlled by a customer activated switch, controlling a rated contactor with a maximum run time of 15 minutes. Contactor shall have a hand-off-auto selector switch with pilot light.

C. The BAS shall prevent the operation of the heaters when the ambient temperature is greater the 5 degrees Celsius.

D. Heaters shall be UL/ULC listed for horizontal outdoor surface and suspended mounting.

E. Enclosures shall be a minimum 20 gauge cold rolled steel finished with powered coated paint.

F. Reflectors shall be one-piece construction and a minimum 0.030 gold anodized aluminum with the proper angle to reflect infrared heat.

G. Elements shall be double tubular infrared quartz tube with high thermal shock characteristics.

H. Each individual unit shall be rated at 4,200W minimum; and

I. Heaters shall nominally extend the full length of the shelters and TSAs.

(xii) Electric duct heaters shall be provided with SCR control.

(xiii) Electric unit heater shall be provided with remote wired wall mounted thermostat.

(xiv) Electric force flow heater shall be provided with remote wired wall mounted thermostat.

(c) Ductwork

(i) Ductwork shall be galvanized steel unless otherwise specified. Construction, joints, fittings and accessories shall be in accordance with the latest SMACNA standards and the OBC.

(ii) Ductwork serving shower exhaust, battery exhaust, humidifiers (two meters downstream), and other corrosive gas or high moisture air shall be stainless steel.

(iii) Flexible ducts shall be manufacturer pre-insulated.

(iv) Flexible ducts shall not be used in Stations.

(d) Supply Diffusers, Registers and Grilles

(i) Diffusers shall be extruded aluminum construction with manufacturer applied finish, and opposed-blade adjustable-volume dampers.

(ii) Registers and grilles shall be extruded aluminum construction a with manufacturer applied finish.

(iii) Registers and grilles shall be equipped with opposed-blade, adjustable-volume dampers.

(e) Intake and Exhaust Wall Louvers

(i) Wall louvers shall be weather resistant, extruded aluminum construction with an insect/bird screen.

(ii) Wall louvers located in public areas shall be located at high level and out of reach of Passengers.

(f) Volume Dampers in Branch Ducts

(i) Adjustable volume dampers shall be provided for all branch ducts serving more than one outlet.

(g) Backdraft Dampers

(i) Dampers shall be counter balancing type for assisted damper operation.

(h) Silencers shall be made of not less than 22 gauge Type G90 galvanized steel or stainless steel to match material of connecting ducts.

(i) Access Doors

(i) Duct access doors shall be provided at each damper, duct heater, and any other accessories and equipment that require Maintenance.

(ii) Access doors installed in insulated ducts shall be pre-insulated.

(iii) Access doors shall be made of same material as ducts they serve.

(j) Fire Dampers

(i) Fire dampers shall be Type B or C dynamic dampers.

(k) Thermal Insulation

(i) Externally applied thermal insulation shall be provided for the ductwork as per ASHRAE 90.1 and OBC, and as indicated below.

(ii) Insulate exhaust air ducts and plenums 3m from the exhaust louver.

(iii) Insulate outside air ducts and plenums to air handling equipment.

(iv) Exhaust air duct from a shower area where duct is in unheated space.

(v) All supply or return air duct transporting air that is above or below the conditioned space design temperature or in an unconditioned space.

(vi) Insulation jacketing in public areas or to public view shall be minimum 0.5mm thick rigid aluminum sheet.

(l) Acoustic Lining

(i) Acoustic lining is acceptable at supply and suction ducts of air handling equipment only when installation of silencer is unfeasible.

(ii) Interconnecting ductwork between the men's and women's washrooms shall be acoustically lined to prevent cross-talk.

(m) Humidifier

(i) Humidifier shall be in-duct type.

(n) Air Filtration

(i) All return air and make-up air shall be filtered.

(ii) The air filters shall be standardized in type and sizes. Where make-up air intakes are located that excessive dirt, debris may be introduced, filters shall be upsized.

(iii) Filters shall be standardized in type and sizes.

(iv) Differential pressure gauge shall be provided across each filter bank and monitored by BAS.

(o) HVAC piping

(i) Non-metallic piping shall not be used in the Facilities.

(ii) Steel pipe shall be ASTM A53 Grade B, minimum Schedule 40; natural gas pipe shall be ASTM A53 Grade B, minimum Schedule 40, seamless.

(p) Instrument Test Ports:

(i) Provide instrument test ports to recommendations of SMACNA/HVAC and in accordance with manufacturer's instructions.

(q) HVAC Systems Controls

(i) Each item of equipment shall have an independent control panel to control the operation of the equipment.

(ii) Where interface between systems (e.g. heating/cooling) is required, a local control panel shall provide control of the equipment. Controls shall be such that simultaneous cooling & heating of the same space is not possible.

(iii) All control panels shall incorporate the ability to send a trouble alarms via the BAS or SCADA to the TOCC.

(iv) Equipment in public spaces shall have vandal/tamper resistant housing and mounting.

5.6 Plumbing and Drainage

(a) Project Co shall provide plumbing and Drainage in accordance with the following:

(b) General design requirements

(i) Each Station shall be serviced by one municipal water connection split prior to the property line for two service connections. Each service is provided with an

isolation valve at the property line. One connection shall be metered for potable water and one un-metered to serve the fire protection systems.

(ii) To the extent possible, piping shall not be embedded in concrete structure.

(iii) Piping shall not be routed through critical equipment rooms.

(iv) Equipment requiring drainage shall not be located directly over critical equipment rooms.

(v) All domestic cold water and domestic hot water pipes shall be insulated as per ASHRAE 90.1 and OBC with a minimum of 25mm thickness insulation.

(vi) All horizontal sanitary pipes and pipes subject to exterior surface condensation shall be insulated with 25mm thickness insulation.

(vii) All storm pipes shall be insulated with 25mm thickness insulation.

(viii) Insulation jacketing in public areas or to public view shall be 0.5mm thick rigid aluminum sheet.

(ix) The incoming domestic water pipes, main sanitary and storm pipes shall be one nominal size oversized to accommodate future expansion. Where new plumbing and drainage systems are connected to existing systems of the existing Station, the existing incoming domestic water pipe, main sanitary and storm pipes shall be replaced with new as required, and the requirements in this Article shall apply.

(x) Domestic cold and hot water pipes, hot water recirculation pipes within the Stations or Facilities shall be copper as per OBC.

(xi) Isolation valve shall be provided at each domestic cold water and domestic hot water main branches and branches that service group of fixtures, area, floor, and equipment.

(xii) Storm, sanitary and vent pipes within the Stations or Facilities shall be copper (less than 100mm in diameter) or cast iron (100mm or greater in diameter).

(xiii) Non-metallic pipes shall not be permitted within the Stations or Facilities, with the exception of buried pipes that are permitted by codes and local authorities.

(xiv) Buried non-metallic pipes shall be provided with tracer wires.

(xv) Metered cold water shall be provided for the leased area.

(xvi) Sanitary and vent pipes rough-in shall be provided for the leased area.

(c) Piping systems

(i) Pipes and fittings

A. Pipes and fittings shall be selected to suit the fluids they are to convey. Pipes and fittings shall be selected such that they exceed the minimum with respect to quality and wall thickness that is allowed for the service and pressure.

B. Corrosion control measures shall be provided for buried pipes where required.

C. Piping exposed to freezing temperatures shall be heat traced and insulated.

(ii) Cold water service

A. The domestic cold water shall be metered per the City of Ottawa requirements.

B. Each service shall have a main shut-off valve immediately inside the structure wall.

C. Where service water pressure is above the recommended, pressure reducing valve assemblies shall be provided.

D. Provide pressure gauge at water incoming pipes.

E. Provide pressure gauges at pump suction and discharge pipes.

F. Provide pressure gauges at inlet and outlet pipes of pressure reducing valves, backflow preventers, and strainers.

G. Minimum fixture service requirements shall be calculated in accordance with the OBC.

(iii) Hot water service

A. Water heaters shall be commercial grade electric (or alternatively natural gas-fired for above grade buildings) meeting the requirements of ASHRAE 90.1 / OBC SB-10 and MNECB.

B. Project Co shall avoid runs of hot water supply piping that exceed 15m, otherwise, hot water recirculation pump shall be provided.

(d) Plumbing fixtures and specialties

(i) Plumbing fixtures shall be water conserving type and shall meet the consumption outlined in the OBC, ASHRAE 90.1

(ii) Shock-absorbing devices shall be provided at each pipe riser, branch, group of plumbing fixtures and other locations in accordance with standard PDI-WH201.

(iii) Emergency eye / face wash and shower stations

A. Emergency eyewash station with tempered water shall be provided in the following spaces:

i. Electrical battery rooms or any other room containing acid batteries;

ii. Janitorial Rooms and any other rooms containing chemicals; and,

iii. HVAC equipment rooms.

B. Station rooms containing a significant amount of chemicals shall be provided with eye/face washes and showers.

(iv) Hose bibs and wall hydrants

A. Provide hose bibs or wall hydrants in all service rooms including HVAC rooms, pump rooms, washrooms, refuse rooms, and open areas such that all open areas of the buildings and the concourses, Platforms shall be reached with a 30m hose. Hose bibs are not required in electrical or communication rooms.

B. Provide non-freeze hose bibs or wall hydrants in locations subject to freezing.

C. Wall hydrants in public areas shall be wall recessed and lockable.

D. To be equipped with integral backflow preventers.

(v) Drinking Fountains

A. Drinking fountains shall be provided at Concourse Levels as required in Article 2 – Architectural Design Criteria, of this Part 4, and as in the Appendices to this Part 4.

B. Drinking fountains shall be provided in Operator's Facilities.

C. Drinking fountains shall feature bottle refill and built-in cooler.

D. Drinking fountains shall be complaint with AODA and COADS.

(vi) Floor drains

A. Provide floor drains in all areas, shafts or rooms where any source of water can be expected, including: public areas, mechanical rooms, HVAC rooms, pump rooms, janitor rooms, washrooms, valve rooms, ventilation rooms, elevator machine rooms, electrical rooms, elevator pits, Operator Facilities, and service trenches.

B. Floor drains in elevator and escalator pits shall be equipped with backwater valves.

C. Provide floor drain at foot grilles at Station entrances.

D. Provide funnel floor drains for condensate and water disposal.

E. Floor drains, funnel floor drains and floor cleanouts shall be heavy duty.

F. Floor drains shall be provided with trap seal primers.

G. Floor drains exposed to freezing temperatures shall be heat traced.

(vii) Trench drains

A. Provide trench drains at top and bottom of stairs at Station entrances and outdoor stairs.

B. Provide trench drains at bottom of other stairs.

C. Provide trench drains at Track level within Stations

D. Provide trench drains at pedestrian underpasses.

E. Trench drains shall be heavy duty.

F. Trench drains shall be provided with trap seal primers.

(viii) Sump pumps & sewage ejectors

A. Sump pumps and sewage ejectors shall be duplex configuration with 100% redundancy.

B. Submersible sump pumps shall be equipped with stainless steel quick connection, installation guide bars.

C. Sump pits shall be equipped with stainless steel ladder, stainless steel gas-tight cover.

D. Large pumps shall be provided with permanent monorail lifting devices.

E. Provide pressure gauges at sump pump discharge pipes.

F. Sanitary pumps servicing elevator pits shall not be located in the elevator shaft.

G. Storm sump pits shall be provided with a sediment trap section.

H. Where oil or grease may be present in the sanitary, oil sensor shall be provided.

I. Pump control panels shall be stainless steel construction and facilitate fault or trouble signals back to TOCC via the SCADA system.

J. All pumping stations shall incorporate level controls with high-level alarms that shall be sent to TOCC via the SCADA system.

5.7 Fire Protection

(a) Project Co shall provide Fire Protection in accordance with all of the following:

(i) General design requirements

A. Fire water service shall be provided with double check detector assembly and installed as per requirements of the City.

B. Provide fire pumps as required to meet code requirements.

C. Provide complete automatic sprinkler system for areas of each Station including the Storage Tracks, Tail Tracks, and Ancillary Facility as required by the OBC, NFPA-130, NFPA-13, and Governmental Authorities.

D. Provide complete standpipe system for all Station and ancillary Facility, and portions of Tunnels within 20m of the Platform. The standpipe system shall meet the requirements of OBC, NFPA-130, NFPA-14 and Governmental Authorities.

E. Provide NOVEC 1230 clean agent fire suppression systems for all communications, transit control, telephone equipment rooms and any other rooms of similar function, in compliance with NFPA-2001.

F. Provide portable fire extinguishers as required by the OBC, OFC, NFPA-10, and Governmental Authorities.

G. Non-metallic pipes shall not be permitted for fire protection systems unless for buried pipes and permitted by codes.

H. Flexible pipes shall not be permitted for fire protection systems.

I. Drum drips in unheated areas for dry systems shall be heat traced and insulated.

(ii) Sprinkler systems

A. Sprinkler systems shall be wet type if not subject to freezing weather conditions; otherwise dry-pipe systems are acceptable upon approval by local authorities.

B. Pipes shall be steel pipe of minimum Schedule 40 meeting ASTM A795/A795M or ASTM A53/A53M Grade B and NFPA 13.

(iii) Standpipe systems

A. Standpipe systems shall be Class I or III, as required by the local Fire Department.

B. Provide standpipe systems for the Storage Tracks and Tail Tracks in the Stations.

C. Fire protection cabinets in public areas shall be flush mounted wall recessed stainless steel.

D. Fire protection cabinet shall contain a portable fire extinguisher.

E. Pipes shall be steel pipe of minimum Schedule 40 meeting ASTM A795/A795M or ASTM A53A/53M Grade B and NFPA 13.

(iv) Clean agent fire suppression systems

A. Where rooms are protected by clean agent fire suppression systems, raised floor and ceiling spaces in these rooms shall be provided with fire suppression systems.

B. Audible and visual alarms shall be provided within the room as well as outside in normally occupied staff room.

C. Pipes shall be seamless steel pipe of minimum Schedule 80 and as required in NFPA-2001.

(v) Portable fire extinguishers

A. Station rooms containing a significant amount of electrical, electronic, and signal equipment shall be provided with CO2 fire extinguishers, in addition to dry chemical fire extinguishers.

B. An additional Class A fire rated water pump tank extinguisher shall be provided within all Stations.

C. Extinguishers in public areas shall be installed in wall recessed stainless steel cabinets.

(vi) Fire department connections

A. Free standing or wall mounted connections and signage constructed of polished bronze or chrome plated bronze. Project Co shall verify the type required by Governmental Authorities.

5.8 Building Automation System

(a) Project Co shall provide an open-protocol BACnet Ethernet LAN BAS system for each Station and each Ancillary Facility to control and monitor all systems, components, and equipment in this Article.

(i) Station BAS system shall be compatible with the BAS systems of the Existing Confederation Line System.

(ii) All Ancillary Facilities supporting bus operations shall be compatible with the existing OC Transpo BAS system.

(b) Project Co shall provide an OWS at each Station and each ancillary facility, complete with a Graphical User Interface, printer, all computer hardware and software.

(c) Project Co shall design and construct systems, components, and equipment that are controlled by BAS to have their own local standalone controllers and monitoring.

(d) Project Co shall design and construct each workstation to be connected to the TOCC, and communicate with other control systems.

(e) Project Co shall ensure that the System has minimum 25% spare points and is expandable for future system expansion without hardware upgrade.

ARTICLE 6 ELECTRICAL DESIGN CRITERIA

6.1 Introduction

(a) This Article presents the basic electrical design guidelines, codes, and standard references that Project Co shall follow throughout the electrical design process of the Stations.

(b) Reuse of existing Station infrastructure is permitted in accordance with the following:

(i) Project Co shall replace all major distribution equipment with a remaining life expectancy of less than 15 years from the date of installation and commissioning. In addition, Project Co shall replace all existing communication, security, and life safety equipment that has less than 5 years of remaining life expectancy at Substantial Completion that is compatible with the new systems.

(ii) Project Co shall perform all rehabilitation, refurbishment etc., as identified in the manufacturer documentation for all existing equipment retained for use in Project Co's design.

(iii) Project Co shall limit the loading (KVA, Amps) on existing services and power distribution equipment where used for the purposes of expanding existing distribution to meet new load demand such as not to exceed 80% of the existing distribution equipment rating. Where the loading of the existing distribution equipment exceeds 80% of its rating with the addition of new loads to meet station expansion, DB Co shall replace such equipment with new equipment that shall meet the new load demand and include a minimum of 25% capacity for future expansion.

(c) Electrical spaces shall be properly located and sized to facilitate the installation and Maintenance of equipment.

(d) The design of the Station electrical systems shall provide for safe, reliable, and continuous operation.

(e) Accessibility shall be provided to permit removal and replacement of major equipment. These requirements are intended to promote uniformity in the design approach and to standardize the type of equipment and its location throughout the System.

(f) Electrical power distribution equipment shall be heavy-duty construction and shall provide arc flash hazard mitigation features to limit PPE to level 2 or lower.

(g) For the design of all electrical systems, sustainable design elements shall be utilized where applicable and practical as recommended by CAN/CSA 802, EnergyStar®, RoHS.

(h) The electrical distribution system shall distribute power for Passenger Station lighting, heating, ventilation and other equipment and systems. Power and circuit requirements for signal and communication systems are subject to other Articles.

(i) All electrical equipment shall be individually identified by unique number matching equipment schedule designation. The label shape, letter size, color coding and background color shall be standardized for the Project. Project identifying labels shall be designated for: cable trays, conduits, junction boxes, cables/wires and all electrical and electronic equipment. In addition to

the identification labels, approval labels shall be provided as required per CSA, ULC, **[REDACTED]**, or **[REDACTED]**.

6.2 Reference Documents

(a) Project Co shall design and construct the Station and Facility electrical systems in accordance with the criteria contained in this Article, all standards, regulations, policies, Applicable Law, guidelines or practices applicable to the Project, including, but not limited to, each of the following Reference Documents. In the event of a conflict between criteria, commitments or requirements contained within one document when compared with another, the more stringent shall apply:

(i) OBC*;

(ii) NBCC*;

(iii) OESC;

(iv) CEC, Part I: Safety Standard for Electrical Installations;

(v) ANSI;

(vi) ULC;

(vii) NEMA;

(viii) CSA;

(ix) IESNA Lighting Handbook;

(x) IESNA, IES RP-20 – Lighting for Parking Facilities;

(xi) ASHRAE 90.1;

(xii) City of Ottawa Standards;

(xiii) NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems;

(xiv) NFPA 110: Standard for Emergency and Standby Power Systems;

(xv) ASME A17.1: Safety Code for Elevators and Escalators;

(xvi) IEEE;

(xvii) IEC;

(xviii) **[REDACTED]** Specifications;

(xix) **[REDACTED]** Specification;

(xx) OC Transpo Transitway and Station Design Guidelines;

(xxi) **[REDACTED]**;

(xxii) IDA-IES; and,

(xxiii) EEMAC.

**Note: Stations located on Federal Lands shall meet the requirements of both the OBC and the NBCC.*

6.3 Basis for Design

(a) Project Co shall provide the Basis for Design in accordance with the following:

(b) Electrical Load Classification

(i) Normal systems include loads which, if de-energized, would have no effect on Passenger safety or adverse effect to Facility systems. This load classification includes all non-essential Station loads and the majority of Station lighting. These loads can tolerate occasional prolonged power outages and do not require a backup power source.

(ii) Emergency systems classed per NFPA 130 and NFPA 110

A. Level 1 systems include loads such as Emergency egress lighting, communication systems (if used in Emergency response procedures) and fire alarm systems that cannot tolerate normal electrical supply outages and require an Emergency power supply.

B. Level 2 systems include loads such as fire pumps, Emergency ventilation and smoke removal systems, sewage pumps, and elevators that require a reliable power source, feeders from two separate and distinct Utility substations or combination of sources as approved by the AHJ.

**Note: Project Co shall perform FMEA and vulnerability/system assurance/reliability analysis in order to determine any other Safety Critical loads that require emergency power.*

(c) Calculations

(i) Project Co shall perform short-circuit calculations to determine the AIC rating of the electrical distribution system based upon the actual available short-circuit value or per-unit impedance values obtained from the **[REDACTED]** at the electric service entrance or point of connection.

(ii) Project Co System device coordination and selectivity shall be based on calculated short-circuit values and used for selection of ratings and settings of protection devices.

(iii) Project Co shall complete voltage drop calculations for maximum loads, long run circuits and feeders, and under motor starting conditions. Motor circuit calculations shall be based on an 85% lagging power factor. Branch circuit

voltage drop from service entrance distribution equipment to point of utilization shall not exceed 5%.

(iv) Project Co shall complete lighting-level calculations for all interior and exterior spaces in conjunction with architectural and/or landscaping design. The point-by-point method utilizing computer-generated calculations shall be used to validate adequate illumination levels and boundaries. The software used shall be industry recognized and the calculations shall follow IESNA procedures. Calculation results shall include maximum, minimum, and average illumination levels along with the appropriate uniformity ratios. Calculations shall also include luminaire locations, mounting heights, manufacture's catalog data sheet with product selections and options indicated, lamp data sheet, wattage, lumens, color rendering index, color temperature, room surface reflectance values, light loss factors, and photometric file used. Lamp or LED fixture color rendering temperature shall be consistent throughout the Station and the Station Site, complement architectural finishes and have CRI of 80 or more within the Station and a CRI of 70 or more throughout the Station site and other areas.

(v) Project Co shall complete arc flash hazard calculations for equipment that is required to be field marked for arc flash warning per CAN/CSA Z462. Hire a Professional Engineer to perform calculations based on actual distribution system installed, actual minimum and maximum available Utility short circuit current and according to IEEE 1584 and CAN/CSA Z462. Values to be calculated shall include, but not be limited to: (a) flash protection boundary in units of centimeter from equipment; (b) incident energy at 45.72cm working distance from equipment in units of calories per square centimeter (cal/cm^2). The calculated values shall be permanently displayed on equipment arc flash hazard warning labels.

(vi) Project Co shall provide computations for service, feeder and branch circuit loads based on the nominal system voltage used and applicable demand factors in accordance with the Canadian Electrical Code.

(vii) Project Co shall provide protection for future growth for all major electrical equipment and **[REDACTED]** service feeders as identified by OC Transpo and the City of Ottawa plus an additional allowance of at least 25% of the total loading, rounded upwards to the next standard rating (KVA or A). Before determining the size of service an economic analysis shall be made to determine the most feasible way of protecting for the future growth. Special consideration shall be given to requirements for load growth, for anticipated usage and life expectancy with particular attention to the possibility of adding heavy loads such as elevators and escalators, electric heating etc.

(d) Electrical Safety Provisions

(i) EGFP shall be provided as required by the latest applicable codes. Ground fault "annunciation only" shall be provided where EGFP is required by code for equipment or feeders serving Level 2 Emergency Systems.

(ii) PGFP shall be provided on branch circuits that have equipment or outlets for which personnel protection is required by either the latest applicable codes or Good Industry Practice.

(iii) Arc flash hazard warning labels shall be provided on the equipment as per required code. Flash boundary and incident energy values shall be displayed.

6.4 Functional Requirements

(a) Project Co shall provide the Functional Requirements in accordance with the following:

(b) Electrical Service

(i) The secondary voltages described herein are the basis of the Reference Concept electrical distribution design. Project Co may select alternative voltages for secondary distribution system.

(ii) The **[REDACTED]** supply strategy for Stations is discussed in **[REDACTED]**.

(iii) A supply point shall be identified by Project Co in coordination with the **[REDACTED]** authority near each At-Grade Station.

(iv) Each Station on the Expanded Trillium line shall be provided with existing or new **[REDACTED]**supply per the **[REDACTED]**, with the exception of Airport Station, which shall receive Station electrical power from the Airport Passenger Terminal Building, and Carleton Station which receives power from a low voltage metered service from a **[REDACTED]**.

(v) Project Co shall utilize existing services and connection assets where possible. The capacity of existing services and connection assets shall be as identified in this Schedule 15-2 – Design and Construction Requirements.

(vi) Where new services are being provided for new Stations, supply points shall be designated and with a reserved capacity of 1 MVA.

(vii) Primary switchgear and transformers shall be provided and owned/maintained by **[REDACTED]**.

(viii) The electrical demarcation point shall be at the secondary side of the transformer. The Civil demarcation point shall be at the property line nearest the designated supply point.

(ix) Project Co shall be responsible for civil work beyond the Supply Point including manholes, duct banks, equipment pads, coordinating civil design with **[REDACTED]**. Project Co shall be responsible for the cost of electrical design and installation including cables, switchgear, transformers as performed by **[REDACTED]** from the supply point to the electrical demarcation point. Costs for **[REDACTED]** shall be attributable to Utility Company Works Cash Allowance; refer to Schedule 15-2, Part 2, Article 8 – Utility Infrastructure Design Criteria.

(x) **[REDACTED]** shall be responsible for design and installation of wiring and connection assets up to the electrical demarcation point.

(xi) The existing Carleton Station is fed from a 100A, 3PH, 600V service from **[REDACTED]**, Project Co shall review the existing loads and service capacity supplied from **[REDACTED]** and assess if the existing incoming electrical service is sufficient meet the new load requirements. If the existing capacity is deemed insufficient to provide the design upgrades, Project Co shall coordinate with the **[REDACTED]** Construction Services Department for upgrades to the electrical service to the station utilizing the 13.2kV high voltage service available at **[REDACTED]** and its preferred equipment vendors. The supply point shall be coordinated with **[REDACTED]** Construction Services Department. Project Co shall provide a 13.2kV/0.6 kV, 3 phase, 4 wire 60Hz transformer, primary side disconnect switch and sub metering. The electrical demarcation point for the station shall be the nearest breaker on the secondary side of this transformer. Project Co shall be responsible for civil work from the 13.2kV supply point including but not limited to manholes, duct banks, equipment pads, coordinating civil and electrical design with **[REDACTED]** Construction Services Department. Project Co shall be responsible for the cost of all electrical and civil design and installation from the 13.2kV supply point to the electrical demarcation point. Revenue metering requirement shall be coordinated with **[REDACTED]** during detail design stage.

(xii) Stations shall receive an underground service from **[REDACTED]**at 600VAC, 3phase, 60Hz. Project Co shall coordinate with **[REDACTED]**to arrange connection at the supply point. Design shall be a transformer installed on an exterior pad or installed within a vault. The demarcation point between **[REDACTED]** and Project Co responsibility shall be the secondary side of the **[REDACTED]** owned on site transformer and the cable terminations for service feeders at **[REDACTED]** disconnect. Project Co shall coordinate with **[REDACTED]**, as referenced in the **[REDACTED]**, all requirements related to the installation of the on-site transformer and underground duct-banks. Passenger Stations shall be provided with 600VAC main switchboard, revenue class metering, associated downstream power distribution panels, feeders to 600VAC and 208/120VAC equipment. Main electrical room/cabinet shall contain, in addition LV transformers, UPS (if applicable), LV lighting control cabinet, heating controls, etc. In the event of power outage Emergency lighting, fire alarm and other emergency equipment loads shall be connected to UPS or batteries as required by OESC.

A. Connection for a mobile generator shall be provided in all Stations. The portable generator system shall be used only for stand-by operation during prolonged Utility outages and is independent of the required emergency (UPS or battery) power supply systems.

(xiii) Electrical protection devices shall be automatically coordinated with upstream/downstream distribution system in order to minimize disruption to the operations.

(xiv) Electric heat tracing shall be provided where required by the mechanical and architectural design.

(xv) All Emergency service raceways/feeders shall be fire rated in accordance with applicable codes requirements. Main feeder raceways shall be embedded in concrete slabs/walls and shall be rated for at least two hours.

(xvi) The superstructure and substructure shall accommodate all required embedded ducts for interior and exterior electrical services as applicable.

(c) Metering and Monitoring

(i) Utility revenue metering shall be provided as required by **[REDACTED]**.

(ii) For loads servicing the Expanded Trillium Line at Bayview Station, these shall be metered separately by a **[REDACTED]** provided revenue class meter.

(iii) Remote monitoring system shall be provided for:

A. Station main switchboard breakers position;

B. Voltage availability at the main buses;

C. Customer energy metering at main service; and,

D. Fire Alarm per CAN/ULC S561.

(d) Duct banks, Manholes and Handholes

(i) Duct banks and manholes shall be designed in accordance with the seismic criteria defined for the Project. Duct banks shall be designed to include at least 25% spare capacity to protect for future growth and expansion. Refer to Paragraph 5.3 (b) (vii) above for direction. In addition, space shall be provisioned for a 24 way fibre to be installed for a separate highways IT network in coordination with the City Highway Operations Department. All ducts to be roped.

(ii) Underground ducts shall be sloped to manholes to provide adequate drainage. Provide concrete encasement where required by applicable code.

(iii) Manholes and/or handholes shall be designed as per City Standards.

(e) Electrical Rooms

(i) Electrical rooms or cabinet shall have sufficient space to house all required equipment. Adequate space shall consider minimum working clearances, conduit entry points and routing, equipment removal / replacement, building repair and ventilation requirements.

(f) Grounding and Bonding

(i) The Station electrical distribution system shall be solidly grounded, designed to meet OESC.

(ii) The grounding electrode system shall be supplemented and bonded together with an embedded ground grid on each side of the Tracks for side Platform Stations. The Passenger Station grounding grid shall not be interconnected with any Traction Power (DC) grounding system. Project Co shall coordinate interconnection grounding points with signal and communication systems to avoid noise propagation.

(iii) Project Co shall provide a separate grounding system for signalling and communication. All signal and communication equipment including cables shall be properly grounded.

(iv) All non-current-carrying metal enclosures and all alternating current equipment shall be securely connected/bonded to the Station grounding system.

(v) Each metallic equipment housing shall provide a welded boss for attaching a protective ground connection and shall be sized for expected trip currents.

(vi) Natural gas piping and pipe connected to an active cathodic protection system shall be avoided with the exception where required by the corrosion protection

(g) Emergency and Standby Power Sources

(i) Power sources shall be selected based on efficiency, reliability and most economic life cycle cost as per CAN/CSA and NFPA requirements.

(ii) Emergency and standby power sources are identified as follows:

A. Standby on-site internal combustion engine generator;

B. *Mobile generator;

C. UPS system;

D. Central battery system or battery packs for unit equipment; and

E. **Second Utility power source – Dual/redundant Utility power source for loads classified emergency Level 2.

**Note: Provisions for quick connection for a mobile generator shall be provided in At-Grade Stations and where practical for underground Stations. The mobile generator system shall be used only for stand-by operation during prolonged Utility outages and is independent of the required emergency power supply systems.*

***Note: Authorities having Jurisdiction shall review the design and approve the dual redundant Utility service feeders as emergency power supply source.*

(iii) When standby fixed mounted engine generators are to be installed outdoors, a completely enclosed weatherproof/sound attenuated housing to protect the generator from adverse weather conditions and reduce sound levels for

surrounding residential neighbourhoods shall be provided. Enclosure shall have critical grade silencing suitable for residential installation. Project Co design shall follow NEMA/IEC/EEMAC enclosure/environmental protection standards.

(iv) When second Utility power source is selected, Emergency lighting, fire alarm and other Emergency equipment loads shall be connected to a UPS or battery system as required for loads classified as "emergency level 1". Automatic transfer switches serving life safety loads shall be equipped with means of bypass to both sources.

(h) General Purpose Receptacles

(i) In public areas, general purpose receptacles shall be GFI and provided at 20m distance, and shall have lockable covers, with the exception of outlets located in the TSA. No more than six outlets shall be connected to a branch circuit.

(ii) GFI receptacles shall be provided also for Station sign boxes and art elements where required.

(iii) In non-public areas general purpose receptacles shall be provided at 7m apart and shall be supplemented where needed for fixed equipment. No more than five outlets shall be connected to a branch circuit.

(iv) A flush-mounted duplex ground fault type receptacle with weatherproof lockable cover shall be provided close to hose bibs.

(i) Lighting

(i) The lighting systems for Stations, Park and Ride areas, pedestrian walkways, trackway, bus Platforms, Tunnels and Tunnel portals shall be coordinated with architectural/landscaping and signage/wayfinding design objectives. Lighting design shall be consistent across all Stations. Standardization of lighting system components is required for perceptual unity and to simplify Maintenance. Lighting design shall be consistent with the principals, philosophy and frame work for lighting design as contained in The Lighting Handbook, Tenth Edition as published by the Illuminating Engineering Society. The recommended maintained illumination targets for items not listed in Table 4-6.1 and Table 4-6.2 shall be based on visual observers group 25-65 for all public spaces as recommended by IESNA, unless otherwise dictated by the building code or accessibility standards. The lighting design shall meet the illumination levels and uniformity requirements for both day and night time operations.

(ii) Lighting levels shall define and differentiate between task areas, decision and transition points, Platform edges and areas of potential hazard. In addition to quantity of light, it is essential that lighting be designed to minimize glare and provide uniform distribution. Luminaires shall be selected, located, and/or aimed to accomplish their primary purpose while producing a minimum of objectionable glare and/or interference with task accuracy, vehicular traffic, and neighbouring areas.

(iii) Luminaires that emit light above the horizontal plane shall be avoided in the exterior design, unless luminaires are located under overhangs or other architectural features shielding the sky from upward light. Luminaires shall be provided with full cut-off optics and if necessary external shielding to minimize light spill-over onto adjacent properties. L. Refer to IESNA TM-11-2000, Light Trespass for Roadway Lighting, and to IDA-IESNA MLO 2011 and addendum A for IESNA TM-07-15 for all other exterior lighting.

(iv) The lighting system shall be efficient using LED light sources and auxiliary equipment. Lighting equipment shall be vandal-resistant where accessible to the general public.

(v) The lighting system shall be designed to satisfy OBC, AODA, CPTED, IESNA, ULC, CE, FCC, CB and CAN/CSA B651 requirements.

(vi) Minimum illumination levels shall meet the criteria listed in Table 4-6.1 below:

Table 4-6.1: Facility Interior

Illuminated Area	**Illumination Targets**		
	E_h **lux**	E_v **lux**	Uniformity Ave: Min
Platform Edge	200 @ floor	60 @ 5'AFF	2:1
Station Rail Platform	100 @ floor	30 @ 5'AFF	2:1
Fare Vending	200 @ 3'AFF	100 @ 4'AFF	3:1
Information Kiosk	300 @ 3'-6" AFF	150 @ 5'AFF	3:1
Stair, Ramps and Escalator Landings	100 @ floor	50 @ 5'AFF	2:1
Pedestrian Tunnels and Concourse	50 @ floor	20 @ 5'AFF	3:1

Transecure Area	200 @ floor	100 @ 5'AFF	2:1
Public Washrooms (General)	150 @ 3'-5" AFF	50 @ 5'AFF	2:1
Plumbing Fixtures	300 @ Top of Plumbing Fixture	100 @ 3'-6"AFF	
Lavatory	150 @ 3'-0" AFF	200 @ 3'-5"AFF	
Building Entries Vestibules Indoor /High Activity			2:1
Day	150 @ floor	75 @ 5'AFF	
Night	100 @ floor	50 @ 5'AFF	

**Note: 1.) All lighting, including, but not limited to Normal and Emergency lighting illumination levels, shall be designed to meet or exceed OBC, accessibility requirements, and security requirements including but not limited to, AODA, COADS, CPTED, ULC, CE, OC Transpo Design Guidelines and CAN/CSA B651 requirements. 2.) Illuminated areas and values not listed in this table shall be per IESNA- Illumination Handbook, 10th Edition. 3.) Table 4-6.1: Facility Interior is applicable to all areas within the Fare Paid Zone of the Station utilized for Train operations and service; and interior spaces of enclosed Ancillary Facilities.*

A. Provision of emergency lighting systems is required by code. Emergency power shall be available at stable system voltage within 10 seconds or less. All batteries shall be sized to continuously carry the rated illumination for a minimum time required for evacuation and as required by applicable code.

B. Emergency lighting fixtures shall be the same model and type as the rest of the lighting fixtures with the addition of emergency battery pack.

C. Lighting system shall be designed so that the failure of any single luminaire or lighting circuit in areas accessible to the public does not leave an area in total darkness.

D. Lighting layout shall be coordinated with other building elements so as not to affect the illumination.

E. BAS system shall monitor and control Station lighting system. Where Facility remote control system is not provided, the following controls shall be provided:

i. Station central key / timer control system including override switches for service areas;

ii. Exterior luminaries, including luminaries in signage, shall be group controlled by photo-cell and/or the facility BAS system. Exterior light control shall include a Maintenance bypass switch (Hand-Off Auto) located on external wall of the facility for night services such as snow plow and cleaning;

F. Exterior Lighting areas as required for safety and comfort shall meet requirement of City Standards, IDA-IESNA MLO 2011, IESNA RP-33 and addendum A for TM-07-15, and ANSI/ASHRAE/IESNA Standards 90.1 Exterior Lighting Section.

G. Site lighting criteria shall be adopted to maintain safe light levels while avoiding off-site lighting and night sky pollution. Computer software shall be utilised to model the Site lighting Technologies to reduce light pollution include full cutoff luminaires, low-reflectance surfaces and low-angle spotlights shall be used.

H. Exterior lighting shall be designed to satisfy OBC, CPTED, AODA, IESNA, ULC, CE, FCC, CB requirements.

I. Minimum illumination levels shall meet the criteria listed below:

Table 4-6.2: Exterior Areas

Illuminated Area	**Illumination Targets**		
	E_h **lux**	E_v **lux**	Uniformity Ave: Min
Building Entries Canopied Outdoor-High Activity	10 to 40 @ grade according to location/ Lighting Zone	6 to 20@ 5'AFF according to location/ Lighting Zone	2:1
At-Grade Pedestrian Crossing	20 to 10 @ grade	10 to5 @ 5'AFF	4:1
Bicycle Parking Area (Covered)	40 to 10 @ grade	20 to 6 @ 5'AFF	2 to 4:1
Bicycle Parking Area (Uncovered)	20 to 10 @ grade	8 to 1 @ 5'AFF	2 to 4:1
Shelter and Ticket Information Area	20 to 10 @ grade	20 to 6 @ 5'AFF	3 to 6:1
Bus Platforms	100 @ grade	40 @ 5'AFF	2:1
Exterior Station Building (Public Area)	20 to 10 @ grade	4 to 0 @ 5'AFF	3 to 6:1
Stairwell	50 @ grade		4:1
Pedestrian Underpasses and Overpasses	Night 40 @ grade	Night 20 @ 5'AFF	3:1

Pathways in the vicinity of Busways	20 to 10 @ grade		6 to 4:1
Pathways/MUPs in the vicinity Stations, as required in Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements	20 to 10 @ grade	4 to 0 @ 5'AFF	6 to 4:1

**Note: 1.) All lighting, including but not limited to Normal and Emergency lighting illumination levels, shall be designed to meet or exceed OBC requirements, accessibility requirements, and security requirements including but not limited to, AODA, COADS, CPTED, ULC, CE, OC Transpo Design Guidelines and CAN/CSA B651 requirements. 2.) Illuminated areas and values not listed in this table shall be per IESNA- Illumination Handbook, 10th Edition.*

(vii) With the exception of items listed in Table 4-6.2 above, lighting levels for Park and Ride surface lots shall be designed and constructed in accordance with IES RP-20 in conjunction with the requirements contained in the OC Transpo Transitway and Station Design guidelines.

(j) Fire Detection and Alarm System

(i) All Stations shall be provided with a fire detection and alarm system in accordance with the applicable codes CAN/ULC S561 and standards.

(ii) The fire detection and alarm system shall be a zoned, non-coded, addressable, microprocessor-based system with automatic alarm initiation, addressable smoke detectors, and automatic multi-detector algorithm for alarms initiated by smoke detectors.

(iii) Fire panels shall include the ability to verify alarms (2 stages) prior to evacuation. The fire alarm wiring system shall be electrically supervised. The system shall be designed such that the TOCC is notified to validate the event and determine if the fire department is to be dispatched when an alarm signal takes place.

(iv) The fire detection and alarm system shall be provided with an emergency power supply, consisting of either a generator and/or battery source. The emergency power supply shall power the supervisory function of the fire alarm system for no less than 24 hours and full function for no less than 30 minutes. Upon failure of the normal power source, immediate transfer to the emergency power supply shall take place with no loss of information in the process.

(v) The fire detection and alarm system shall be connected to the TOCC and monitored by the City's ULC listed monitoring company.

(vi) A fire alarm annunciator panel with a flush mounted vandal resistant polycarbonate shield shall be provided at every Station in a readily accessible location to fire fighters upon entering the Station. The annunciator panels shall be monitored simultaneously by the City's ULC listed monitoring company.

(vii) Manual pull stations need not be installed in areas accessible to the public.

(viii) Visual signal devices shall be installed such that the signal from one device is visible throughout the floor area in which they are installed.

(ix) Fire alarm/PA overrides shall be through SCADA.

(k) Power for systems and communication equipment

(i) Power or conduit complete with pull wire shall be provided as required.

(l) Conduits and Raceway

(i) Conduits installed in finished areas of new construction shall be concealed in walls, below or in slabs, or above suspended ceilings. Exposed conduits shall not be run on the exterior surface of buildings. Conduits shall not be run through structural members across pipe shafts or ventilation duct openings.

(ii) Conduits in concrete slabs shall be placed between the bottom and top reinforcing steel. Separate conduits to ensure proper concrete bond.

(iii) Conduits shall not be embedded in waterproofed or waterbearing walls.

(iv) Conduits penetrating exterior walls of any Structure (other than handholes, manholes, or pullboxes) below grade, at grade floors, or below grade floors shall be sealed to prevent moisture migration.

(v) Grounding-type expansion fittings shall be installed in raceways every 60m or less of linear run or wherever structural joints are crossed to allow for expansion and contraction.

(vi) Project Co shall provide the raceway system and cable pulling for equipment described and identified by facility/systems and the City. Raceways shall be designed to include at least 25% spare capacity to protect for future growth and expansion. Refer to clause 6.3 (b) (vii) of this Part 4 for direction.

ARTICLE 7 WAYFINDING AND SIGNAGE

7.1 Introduction

(a) This article describes wayfinding and signage performance requirements for the Project including performance criteria for wayfinding and signage design.

(b) The performance specifications provide brand neutral examples for the application and integration of a comprehensive wayfinding and signage system with the specific architectural and art finishes and features of the Project.

7.2 Goals & Objectives

(a) The overall goal of this Article is to provide a standard signage and wayfinding system that makes transit Facilities easy to identify and navigate System wide, that utilize language and visual techniques that people understand, comply with accessibility guidelines, integrate with the design approach of other design disciplines and assist in delivering a successful journey for Passengers.

(b) The objectives for the wayfinding and signage program are as follows:

(i) To improve the overall function and aesthetics of the Project by providing accessible, attractive, identifiable and understandable signage;

(ii) To improve wayfinding for Passengers by providing map, text and or pictograph signage for important Station destinations and features;

(iii) To provide plain language signage and not ‘over sign’ Stations;

(iv) To develop Project outcomes that inform and meet the timing of the design requirements for Station pre-engineering and final designs; and

(v) To achieve the above goals sustainably.

7.3 Scope

(a) This Article includes requirements for the design, manufacture, supply, delivery, storage, assembly, installation, protection, inspection and testing of all components as described herein, necessary to achieve and deliver a successful, comprehensive and integrated wayfinding and signage system for the Project.

(b) The wayfinding and signage system shall be consistent with the Confederation Line signage and wayfinding system.

(c) The wayfinding and signage system includes but is not limited to providing signage that addresses the following areas and uses:

(i) Station identification signage - Signage that identifies a Station and is visible whether approaching a Station by foot, bicycle, transit vehicle, taxi or private vehicle;

(ii) Community orientated wayfinding signage - Signage that identifies and provides a link to other modes of transport, public services, landmarks, pedestrian and bicycle routes or significant destinations in the general vicinity of each Station;

(iii) Station located wayfinding signage - Signage that assists the movement of Passengers through a Station or to facilities located within the Station. This includes signage that identifies and or directs users to and from Platforms, exits, ticketing and fare payment facilities, information services, elevators, TSAs, escalators, accessible pathways, bicycle routes through each Station, taxi and connecting bus services;

(iv) Navigation signage - Signage that works in conjunction with (iii) and provides wayfinding through the available multi modal forms of transportation by identifying directions, major destinations, adjacent Stations and confirms the appropriate transport service. Signage indicating the locations of transit information panels shall be provided;

(v) Schedule and service status signage - Signage that displays real time information on the status of transport services communicated through the use of dynamic visual displays, panels, electronic updates and audio announcements when a service is operating, due to arrive, delayed or cancelled and provides information and notices for hours of operation, trip schedules and timetables; and

(vi) Regulatory and Utility signs - Signage used within a Station that provides users and staff with regulatory notifications such as no smoking, hazards, no littering, emergency exit, emergency phones, fire alarms, elevator buttons, rules of use, disclaimers, etc. Standard traffic signage is also required for private vehicles and for buses circulating through or around a Station.

7.4 General Responsibilities

(a) Project Co shall design, fabricate, install, and Maintain all wayfinding equipment.

(b) The Project Co shall propose content of all wayfinding equipment, including signage (directional, orientation, information, regulatory, commemorative), electronic displays, transit information panels, and maps, and will provide such content to City to review at the appropriate stage of design.

(c) Proposed wayfinding equipment shall be coordinated and compatible with Confederation Line wayfinding equipment.

(d) Wayfinding equipment shall support and contribute to the transit customer experience on the System and overall transit network.

7.5 General Requirements

(a) Reference Documents

(i) The design and construction of wayfinding and signage shall comply with the criteria contained in this Article, and all standards, regulations, policies, Applicable Law, guidelines or practices applicable to the Project, including but not limited to each of the following Reference Documents. In the event of a conflict between criteria, commitments

or requirements contained within one document when compared with another, the more stringent shall apply:

A. OBC;

B. AODA;

C. COADS;

D. OC Transpo Transitway and Station Design Guidelines.

E. Confederation Line Signage and Wayfinding documents,

F. Canadian Transportation Agency, Code of Practice, Passenger Terminal Accessibility

G. Canadian Transportation Agency, Code of Practice, Removing Communication Barriers for Travelers with Disabilities

H. City of Ottawa Construction Specifications and Details; and

I. Ontario Traffic Manual.

J. OC Transpo Signage and Wayfinding Manual

(b) Signage System design

(i) Design for the wayfinding and signage system for the Project is comprised of identification, directional, information, operational, regulatory, and temporary signage.

(ii) The City shall determine Station names for all Stations.

(iii) Identification Signage

A. The key functions of the identification signage are to identify:

i. Stations within the built environment;

ii. Station entries;

iii. Station facilities;

iv. Passenger services and amenities;

v. Elevator access; and

vi. Accessible entries.

(iv) Directional Signage

A. The key functions of the directional signage are to direct:

i. Passengers from the Station entries to ticket machines and fare gates on to the Platform and to the exits;

ii. Passengers to connecting modes and infrastructure;

iii. Passengers to facilities within the Station; and

iv. Passengers to accessible access points.

(v) Information Signage

A. The key functions of the information signage are:

i. Provide transit information;

ii. Notify Passengers of available services; and,

iii. Notify Passengers of delays or changes to scheduled services.

(vi) Operational Signage

A. The main purposes of the operational signage are:

i. Identify doors, areas and access points for staff and facilities management;

ii. Identify ancillary room functions; and,

iii. Video surveillance signage.

(vii) Regulatory Signage

A. The key functions of the regulatory signage are:

i. Identify potential hazards to Passengers and the public; and,

ii. Identify potential hazards to staff and Third Party Contractors.

(viii) Temporary Signage

A. The key function of temporary signage is to:

i. Temporarily identify changes to services, Station facilities, Station closures or hours of operations;

ii. Temporarily identify hazards to Passengers and the public; and,

iii. Temporarily identify hazards to staff and Third Party Contractors.

(ix) Sign Types shall be consistent with Confederation Line signage.

(x) Sign Dimensions shall be consistent with Confederation Line signage.

(xi) Project Co shall use the Confederation Line signage packages provided in Appendix C of this Part 4, which includes expectations for sign dimensions, sign and information hierarchy, sign types, sign content, visibility, contrast, layout, sign mass and sophistication.

(xii) Sign Quantities

A. Project Co shall be responsible for designing the wayfinding program including providing sufficient quantities of signs as deemed necessary to design and supply a clear, concise and consistent wayfinding sign system in order to meet the Project requirements.

(xiii) Sign Information

A. Project Co shall be responsible for updating and maintaining sign information content and messages to ensure that all signage is relevant and reflects relevant changes to the City transit System.

(xiv) For Stations subject to FLUDTA, the following requirements apply:

A. Signage design shall comply with the NCC commercial signage guidelines.

B. All text shall to appear in both official languages.

C. Exterior signage shall not be permitted above the ground floor level.

D. Backlit signage, with the exception of Station entrance lanterns, billboard signage and digital signage shall not be permitted outside of the Station.

(c) Design Elements and Considerations

(i) The design and implementation of the Project wayfinding and signage system requires Project Co to incorporate the following key considerations and elements into the designs.

(ii) Line & Letter Spacing

A. Line spacing where a set of messages is displayed shall be at least 75% of the Cap height so messages can be quickly scanned and destinations identified.

(iii) Language

A. All signage for the Project shall feature messages in both English and French.

B. Where both languages appear on a single sign, Project Co shall follow one of the following two options:

i. English text on the left side and French text on the right; or

ii. English text on the upper portion of the sign with French text below.

C. Where pairs of signs are used the sign displaying English text shall be placed at the beginning of the viewing sequence with the second sign in French located beyond it.

D. Where the two signs are required they shall be far enough apart to ensure the messages are differentiated and not read as a single message and close enough to one another allowing users to recognize that they represent the same message displayed in the two languages. A minimum gap of four character strokes shall be maintained between English and French messages. A minimum of two character strokes shall be permitted where a graphic device such as a vertical line or hyphen is used to visually separate the two messages.

E. Bilingual or unilingual paired signs shall employ the same size, fonts, letter heights, colours and general design principles for each language.

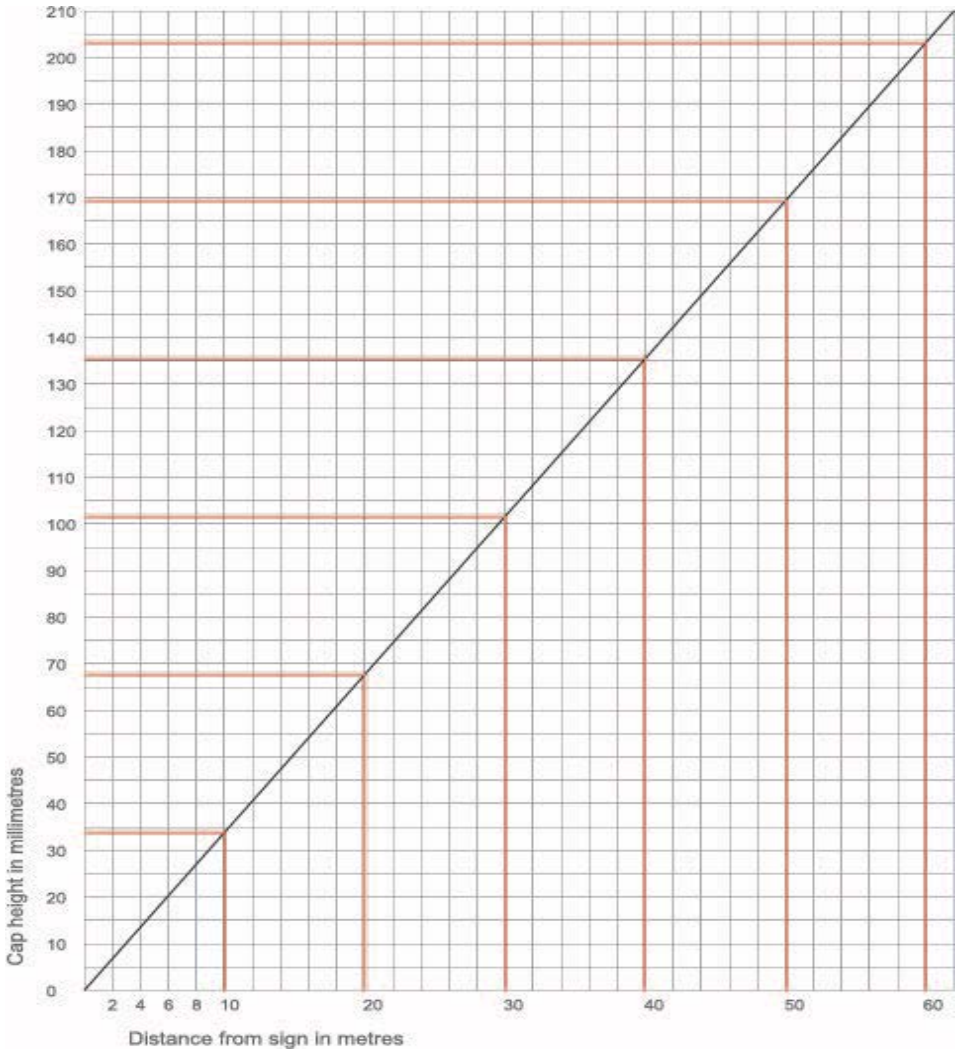
(iv) Pictograms

A. Pictograms shall be used to reinforce sign messages, aid quick recognition and clearly communicate information to all languages and cultures.

B. Pictograms shall be based on Confederation Line standards approved by the City. Any additional pictograms proposed by Project Co that are not based on the existing standards shall be presented to the City for acceptance.

(v) Legibility & Viewing Distance

A. All signage shall be legible and feature letters and graphic elements of the appropriate size for the identified viewing distances. The chart below provides the viewing distances for text of a particular height. These values are based on the viewer having good vision and reading the signs in daylight whilst stationary.



B. It shall be noted that many factors negatively impact the legibility of sign text. These include angular distortion, speed of travel and low light levels. Factors such as these shall be considered when determining the height of text appearing on signs. Project Co shall increase text heights from those described in the chart as required to maintain sign legibility based on the impact of the above conditions.

(vi) Mock ups of all sign types shall be provided by Project Co to assess the legibility of the proposed design and text heights. Mock ups shall be reviewed by user groups comprised of a cross section of the community and representing people with diverse abilities.

(vii) Sign Placement

A. Signage shall be placed in visible locations, free from obstructions. Special care shall be taken to ensure that signs are not obstructed by other signs, design elements or items such as security cameras.

B. Project Co shall place signs within the accepted standard for a viewers' cone of vision, being 15° above and below the viewers' horizontal line of sight. Signs viewed outside a viewers' cone of vision are read peripherally and with much less detail. Project Co shall consider the viewers' cone of vision when selecting the height of the sign from floor level and the height of the typeface.

C. The average persons' eye level when standing is 1500mm from floor level. When seated it is approximately 1000mm from floor level and when driving eye level is approximately 1200mm from floor level. Signage shall be placed depending on how it shall be viewed and taking into account differences in eye level and a sign's audience.

D. Placement of signage shall be coordinated with the landscaping, architecture, interior design lighting and other equipment in order to standardize locations within a Station and across the System. Signage shall be applied consistently, assist users to know where to expect sign information and aid navigation.

(viii) Contrast and Colour

A. Project Co shall ensure contrast between sign backgrounds and messages are at a level considered acceptable to maintain sign legibility and deliver a successful signage system.

B. For environments with light levels between 10-70 foot candles Project Co shall provide signs with a contrast of 75% or higher between the background and message.

C. For environments with higher light levels (70 foot candles and above) Project Co shall provide signs with a lower contrast level of 65-75%. A dark background shall be used to absorb light and prevent glare.

(ix) Halation

A. When signs are backlit care shall be taken to reduce flare or halation. Halation makes backlit or reversed lettering difficult to read especially when travelling at speed or at night. Project Co shall ensure that signs are designed to minimize the effects of halation. Directional signage shall not feature designs which purposely use the effect of halation as a feature. This includes signage with halo lighting effects.

B. Internally illuminated signage shall have reversed opaque or translucent backgrounds to reduce halation and increase legibility.

C. Internally illuminated signs shall not feature light coloured illuminated backgrounds.

(x) Lighting

A. Design and implementation of internal or external signage illumination shall be coordinated by Project Co with the City to ensure compatibility with the design intent for the overall lighting scheme.

(xi) Universal Design

A. The principles of Universal Design shall be applied to designs for the wayfinding and signage system by Project Co. The signage system shall whenever possible seek to integrate accessible design features with the design as a whole. The goal is to deliver a wayfinding signage system that assists in providing an environment accessible to people with all levels of abilities. As a minimum, signage for the Stations shall be designed in accordance with the relevant accessibility codes referenced in this document. All directional signage shall be located in compliance with the stated codes.

B. The application of tactile indicators shall be coordinated with key sign locations to assist with the recognition of tactile signage locations and aid navigation by the visually impaired.

(xii) CPTED

A. The principles of CPTED shall be applied in order to ensure the design and placement of the wayfinding and signage system does not compromise the safety of Passengers or the general public. In general, signage shall enhance public safety by providing uninterrupted Site lines in critical areas, reduce areas where people or devices may be concealed and provide sufficient information to users to instil confidence and minimize confusion. All Station, security facilities and supporting transport services shall be easily differentiated and identified whilst being recognisable as part of an organised system.

(xiii) Vandalism

A. All signage elements shall be designed and fabricated to dissuade and provide protection against vandalism and graffiti.

B. Tough, scratch and impact resistant materials shall to be utilized to resist damage, maintain appearance, increase product life spans and reduce operational costs. Sacrificial and non-sacrificial anti-graffiti coatings shall be applied to signs where the risk of graffiti is deemed to be high.

C. All accessible mechanical fixings shall be ‘security fixings’ with nonstandard drives. All accessible fixings shall be tamper proof.

D. Damaged signs shall be repaired or replaced by Project Co in a timely manner and without negatively impacting Passengers, staff or the general public.

(xiv) The City Branding Integration

A. Project Co shall be responsible for the integration of the City branding with their Station design solutions and utilizing the city graphic designs and solutions for wayfinding and signage system from the Confederation Line.

(xv) Local Conditions

A. All signage components designed and supplied by Project Co shall be fit for purpose, able to perform in the climatic conditions outlined in Schedule 15-2, Part 1, Article 4 – Design and Construction.

B. The effects of snow, ice and the effects of methods of snow dispersal on signage shall be addressed in the design.

(d) Fabrication Materials & Finishes

(i) Sign material selections and colours are subject to final brand review by the City.

(ii) Metalwork

A. All work shall be accurately and neatly constructed and securely fitted and fixed.

B. Project Co shall use types and grades of metals suited to their required function, finish and method of fabrication, in sections of adequate strength and stiffness for their purpose.

C. Where appropriate, prefabricate and preassemble items in the workshop before delivering items to Site.

D. Care shall be taken to ensure all visible metal surfaces are free from damage, scratching or other surface degradation.

E. Fabrication techniques, surface detailing and application of finishes shall be closely controlled to ensure continuity of appearance between individual items.

F. All visible metal edges shall be cut with machine tools. No visible edges of metal shall be cut with a guillotine or break press. No radius to edges unless specified.

(iii) Stainless Steel

A. All stainless steel used externally; in basement levels and non-air conditioned areas shall be marine alloy, AISI grade 316. In internal areas all stainless steel shall be grade AISI grade 304 unless otherwise specified.

B. All stainless steel surface finishes shall be factory or machine finishes. Stainless steel products with a standard mill or 2B finish shall not be hand linished or polished, by the contractor to match factory finishes.

C. All brushed or linished stainless steel shall be No.4 linish unless otherwise specified. Grain of finish is to run with long dimension of each sign unless otherwise specified.

D. All polished or mirror stainless steel shall be No.8 mirror finish, unless otherwise specified.

E. All surfaces shall be ground and polished to produce uniform, directionally textured, polished finishes free of cross scratches.

F. All corners shall be 90° and mitred, with a hairline joint and with surface finishes meeting at mitre. No visible welds.

(iv) Aluminium

A. All aluminium shall be of an alloy suitable for purpose. For signage applications where sheet and plate is required, alloy 5005 shall be used.

B. All welding shall be carried out in accordance with international standards, using techniques to avoid buckling and discolouration.

C. All exposed welds shall be ground smooth and where aluminium is to be painted all surfaces shall be suitably sanded, primed, filled and smoothed prior to final paint treatment.

(v) Mild Steel

A. Steel components shall be of quality mild steel of a gauge and alloy appropriate for location and use.

B. Method of welding used shall provide the maximum strength along joints, fill all gaps and run to a clean and regular finish. All welds shall be continuous along joints with no raw or exposed edges.

C. Irregular welds shall be ground smooth with particular attention to visible areas.

D. After fabrication and prior to pre-treatment and finishing processes, all rust, scale, burrs, weld slag and splatter shall be removed from the weld and surrounding areas.

E. Steel work shall be free of grind and machine marks by way of linishing or sandblasting without causing damage to the designed form or creating surface irregularities.

F. All mild steel framing and signage support Structure, located in external areas shall be hot dipped galvanised regardless of the application of paint finishes unless otherwise specified.

(vi) Glass

A. All glass used in the fabrication of signage shall be toughened safety glass.

B. Where glass is used in conjunction with applied graphics for the purposes of visual display, all glass shall be low iron toughened safety glass.

C. All edges shall be ground and polished smooth. All edges shall be square without chamfered or sharp edges.

D. All glass installations located in direct contact with Passengers and staff shall be certified by a Professional Engineer.

(vii) Acrylic & Polycarbonate

A. All acrylic used shall contain 90% or more Polymethyl methacrylate.

B. Where possible cast acrylic shall be used instead of extruded acrylic or polycarbonate products.

C. Cut edges shall be finished smooth and polished. No flame polished edges shall be provided.

(viii) Fastenings

A. Fastenings, including anchors, lugs, screws, rivets, and the like shall be fit for purpose and capable of transmitting the loads and stresses imposed. All fastenings shall be sufficient to ensure the assembly is secure and rigid.

B. All fastenings and associated components such as sleeves shall be finished to match the sign body treatment and colour, unless otherwise approved.

C. All exposed screw heads shall be countersunk. All screw heads shall finish flush with the adjacent exposed surface.

D. Project Co shall ensure that all fixings are protected against corrosion and will not mark or stain existing finishes.

E. Fixings shall be compatible with the types of metal they are used to secure.

(ix) Welding

A. Welded, brazed or soldered joints on exposed surfaces shall be ground, buffed or polished as applicable to the material and specified finishes. There shall be no buckling or visible surface colour variations in exposed metal finishes.

B. Welds and brazes on finished surfaces shall be indistinguishable from the parent metal.

(x) Precision Cutting

A. All cut edges shall be smooth, ground and polished. No visible cut marks, burn marks, splatter or discolouration shall be accepted.

B. All start and end cuts for laser and waterjet cutting and shall be located outside the form to be cut. All cut edges shall be de-burred. All edges shall be square. No sharp edges.

(xi) Metal Separation

A. Incompatible metals shall be separated to prevent galvanic reactions. Separation materials shall not be visible on exposed surfaces or cause discolouration to the surrounding finishes over time.

(xii) Graphic Films

A. All corners and edges of finished letterforms, numerals, arrows, pictograms, logotypes and other graphic elements shall be sharp and true to the selected typeface or artwork, with accurate even curves and serifs where applicable.

(xiii) Screen Printing

A. All screen-printed graphics shall be applied according using a screen of 120 threads per inch. Registration shall be accurate.

B. Screen printing ink shall be Sericol Polyscreen 2 pac system or similar.

(xiv) Anti-Graffiti Coatings

A. All applied coatings shall be compliant with the sustainability goals for the Project and be applied to the manufacturers' instructions by qualified personnel trained in the correct use and application and/or removal of these types of products.

(e) Electrical

(i) Internal Lighting

A. Project Co shall ensure that all illumination is fit for purpose and provides even illumination. No shadows, visible wiring or hotspots shall be permitted.

B. Project Co shall fabricate all signs with internal lighting in such a way as to prevent all light leaks

C. All control gear shall be compatible with the lamps used and shall be located within the sign or concealed in a remote location. In all cases Project Co shall ensure that all control gear including transformers, drivers and ballasts are installed in an accessible and safe location which does not interfere with the functioning of the lighting or the sign itself.

D. All wiring shall be encased in non-conductive, insulated, electrical conduit, fit for purpose.

E. All ballasts and control gear shall be electronic. No solid core transformers or ballasts shall be used.

F. All interior lighting fixtures located underneath skylights shall be full cutoff.

(ii) External Lighting

A. Where additional illumination is required for the purposes signage illumination, light fixtures shall match in colour temperature, lumen output and intent.

B. All exterior lighting fixtures shall be full cutoff, and to comply with City bylaws.

(iii) Activation of Signage Illumination

A. Activation for sign illumination shall be controlled by the Station BAS.

(iv) LED Displays

A. Project Co shall be responsible for the design and placement for all LED displays. Project Co shall be responsible for the design and supply of all shrouds and fixing systems required to maintain a consistent design language and integrate the displays with the designs for the wayfinding and signage system. Design of the shrouds and or fixing systems shall not negatively impact the performance of the base LED displays in any way.

B. Placement of LED displays as part of the Passenger information systems shall be the responsibility of Project Co. Placement of Passenger information displays shall not obscure or interfere with the operational performance of the wayfinding and signage system.

7.6 Conditions

(a) Site

(i) Site Conditions

A. No signage shall be fabricated or finished onsite.